Concrete

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Bulk Cement for Foundations Under World's Largest Business Building

Bulk Cement Delivered by Boat Directly into 5000-Barrel Hopper Over Mixing Plant—45,000 Cubic Yards of Concrete in Caissons — Plant Layout — Concrete Control

ASIDE from the magnitude of the project itself, interest in the construction of the foundations for the new $30,000,000 Merchandise Mart, America's largest business building, centers around the unusual method of delivering the bulk cement used and the design of the mixing plant.

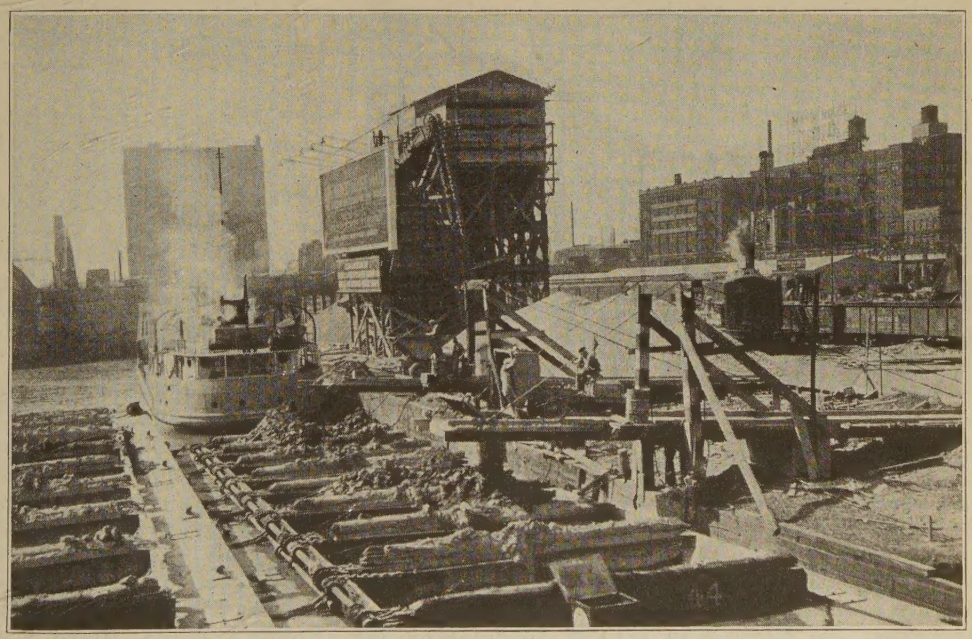
For the first time in Chicago's building history, cement is being purchased "f.o.b. the contractor's material bins." The manner of delivering the cement and the problems involved are features of this unusual job.

The new Merchandise Mart is being constructed on the site of the former passenger station of the Chicago and Northwestern Railway. The project includes the largest single development of air rights so far scheduled. Except for the 452 caissons on which the building will rest, the entire structure will begin 23 ft. above the level of the tracks, which will continue to be used under the building. The structure will extend 724 ft. on Kinzie St., 324 ft. on Wells St., and 577 ft. on the Chicago river front, with a diagonal frontage on Orleans and Franklin Sts.

The Mart will have a total floor space of about 4,000,000 sq. ft. as compared with slightly more than 2,000,000 sq. ft. in the Chicago Furniture Mart, the next largest building. Each of the main 18 floors will have an area of over 200,000 sq. ft., and the structure will be topped by a 5-story tower.

Cement Delivery

The fact that one of the sides of the building parallels the Chicago river made it possible to deliver the cement in the manner adopted. Near the river's edge and between it and the first tracks of the Chicago and Northwestern Railway, the central mixing plant, supplying the concrete for the caissons, is located.



The river front at the job. Opposite the mixing plant is the Daniel McCool delivering a load of 2,000,000 lbs. of cement. In the foreground are the barges and the cantilever runways from which the excavated materials are dumped

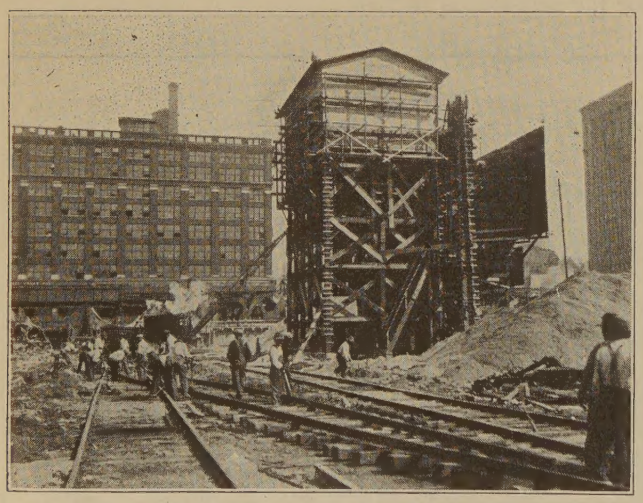
Cement is received in a specially designed steel boat, owned by the Manitowoc Portland Cement Company. The boat is loaded at the company's cement mill at Manitowoc, Wis., shipped to the site of the job and unloaded directly into the mixing plant bins. This is the first boat equipped with a Fuller-Kinyon cement pump which makes it possible to convey the cement in a pipeline a distance of 135

A close-up showing the piping through which the cement is pumped from the boat into the bins

ft. horizontally and 75 ft. vertically into the bins. It requires approximately seven hours to unload the boat and to place the 5,000 barrels or 2,000,000 lbs. of cement in the hoppers. Three trips per week will be made until the 100,000 bbls. needed for the caissons have been delivered.

Central Mixing Plant

The problem of designing a central mixing plant surmounted by a cement storage bin capable of holding 2,000,000 pounds of cement is not a usual one. In addi-



The central mixing plant. The top section is used for bulk cement storage. The aggregate bins are located between the cement storage and the large sign to the right. Note the elevator which feeds the sand bins. A similar elevator on the other side of the plant feeds the gravel bin

tion, bins for the storage of 500 cu. yds. of sand and gravel are provided.

Aggregates are received in railway gondolas on the C. & N. W. Ry. tracks paralleling the mixing plant. Gravel is unloaded into a storage pile on the east end of the plant by a traveling crane and sand is unloaded in a similar manner onto a stock pile at the west end of the plant. From the stockpiles the materials are scraped into pits. Link-Belt bucket elevators, one on each side of the plant, elevate the aggregates into the bins.

The three aggregate bins are on the river side of the mixing plant, lower than, and parallel to the cement bin. The center aggregate bin provides storage facilities for 250 cu. yds. of gravel and the two end bins hold 125 cu. yds. of sand each.

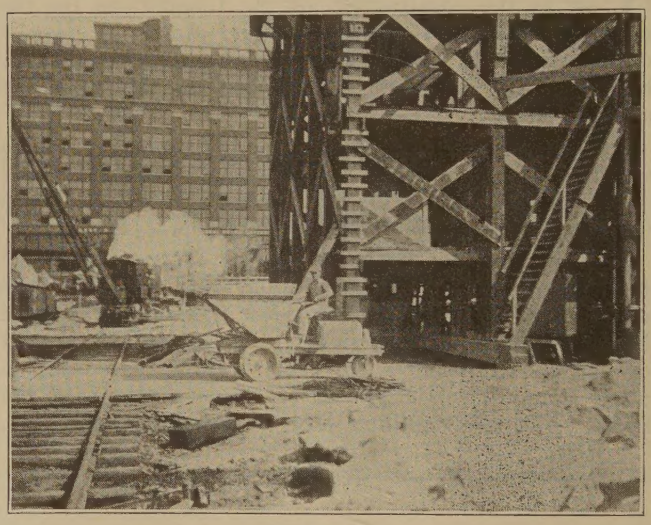
Proportioning

Directly under the cement bin is a Blaw-Knox measuring hopper which proportions the cement for the two Koehring 1-yd. mixers. The sand and gravel are measured by volume, the center gravel bin supplying both mixers. Sand is taken from the two end bins, each bin supplying the mixer nearest to it.

A 1:1:2 mix is used. The materials are kept in the mixer for a full minute and a half and the water content is limited to three gallons per sack of cement.

Caisson Construction

As previously mentioned, there are 452 caissons in the foundation plan. These vary from 4 ft. 9 in. to 9 ft. 6 in.



A Clark tructractor taking a load of concrete from the mixing plant to the caissons

in diameter and are about 80 ft. deep. Each caisson contains from 90 to 150 cu. yds. of concrete.

Excavation is made by hand and each caisson hole is served by an electric winch made by the Thomas Elevator Co. The excavated material is hoisted in buckets and dumped into hoppers mounted on Clark tructractors. A fleet of eight of these tructractors convey the excavated material to a cantilever runway extending out over the river, from which the material is dumped into barges. The runways are built with trap doors near the extended ends so that the dirt can be dumped either through the trapdoor into the near side of the barge or from the end of the runway into the far side of the barge.

Four other Clark tructractors, equipped with a 1-yd. dump body, receive the concrete as it leaves the mixer and convey it to the caissons where it is dumped into the forms.

The contract for the foundations was awarded to John Griffiths & Son Co. The architects are Graham, Anderson, Probst & White. Bruce A. Gordon is superintendent for the contractors and Geo. Allen is the architects' representative.

Concrete Masonry Used for First Time in Major Construction

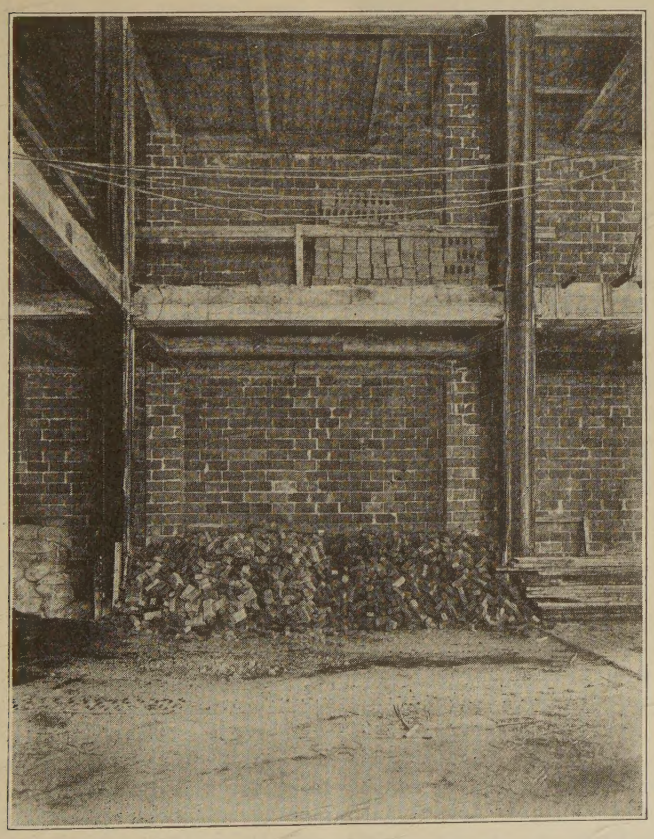
How Aggressive Merchandising Won a Big Order and Service Won a Repeat Order—Concrete Masonry Units Used in Two Important Philadelphia Tall Buildings

FOR the first time in the history of building in Philadelphia, concrete masonry units are being used for back-up, partitions and fireproofing in real skyscraper construction. They will be used from basement to pent-house in the 25-story Integrity Trust Building which now is being built at the southeast corner of Sixteenth and Walnut Streets, Philadelphia. At this writing, August 13th, the structure is up fifteen stories. It is expected to have it ready for occupancy by November 1st.

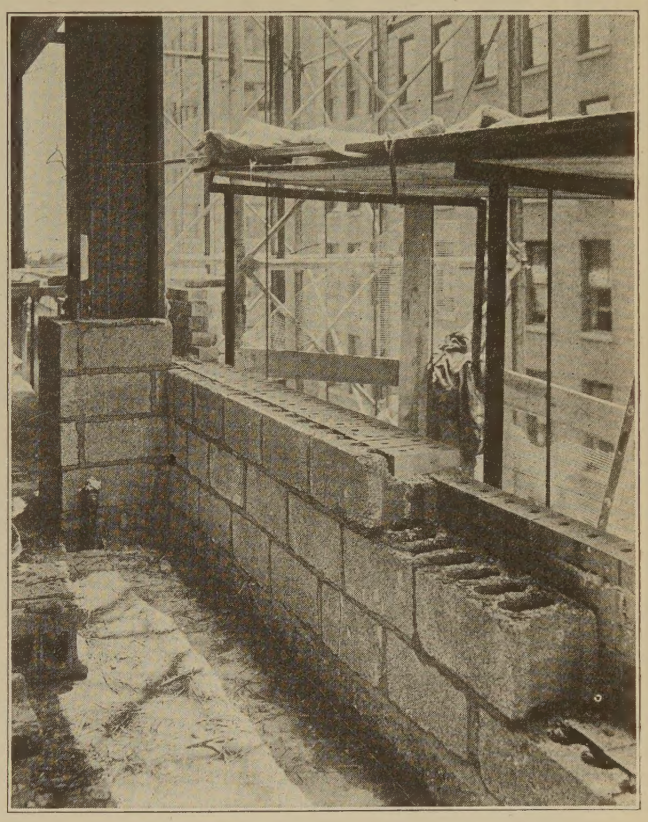
When completed this structure will contain a total of 350,000 cinder concrete units in various sizes and 1,000,000 cinder concrete brick. Quite a sizable order, as any salesman will agree.

Salesmanship and Service

And it took real salesmanship, combined with service, to land the order. Concrete products men will take their hats off to Henry ("Hank") Crowell of the Philadelphia Partition and Building Block Company, a subsidiary of the National Building Units Corporation, for this job of work. He scored a triumph not only for his own organization but for the whole industry as well when he obtained such important recognition of the merits of concrete masonry. It wasn't a high pressure job either. Intelligent thinking and working plus the assurance of real service were back of this salesmanship feat.



Concrete units were used throughout for backup, partitions and fireproofing



Placing concrete block for backup on 25-story building

The nature of the construction required many units of odd sizes and shapes. Could Mr. Crowell's plant furnish them? Mr. Crowell assured the architect and builder that his plant could not only supply the units of the necessary sizes and shapes but would deliver them where and when they were needed. They are being delivered on time. Not only that, they are being delivered in such a systematic manner that the masons on the job do not have to search and swear when they come to places where the odd size units are needed. Waste and cutting have been virtually eliminated, which means ideal construction conditions.

The Philadelphia Partition and Building Block Co. worked out a schedule of the proper size units for each floor. The importance of this scheduling job becomes more impressive when it is pointed out that variations in the dimensions of the steel and openings on the various floors required special masonry handling on each floor.

The most important thing of all about this record sale

of concrete masonry is the fact that the order will show a decent profit for the manufacturer.

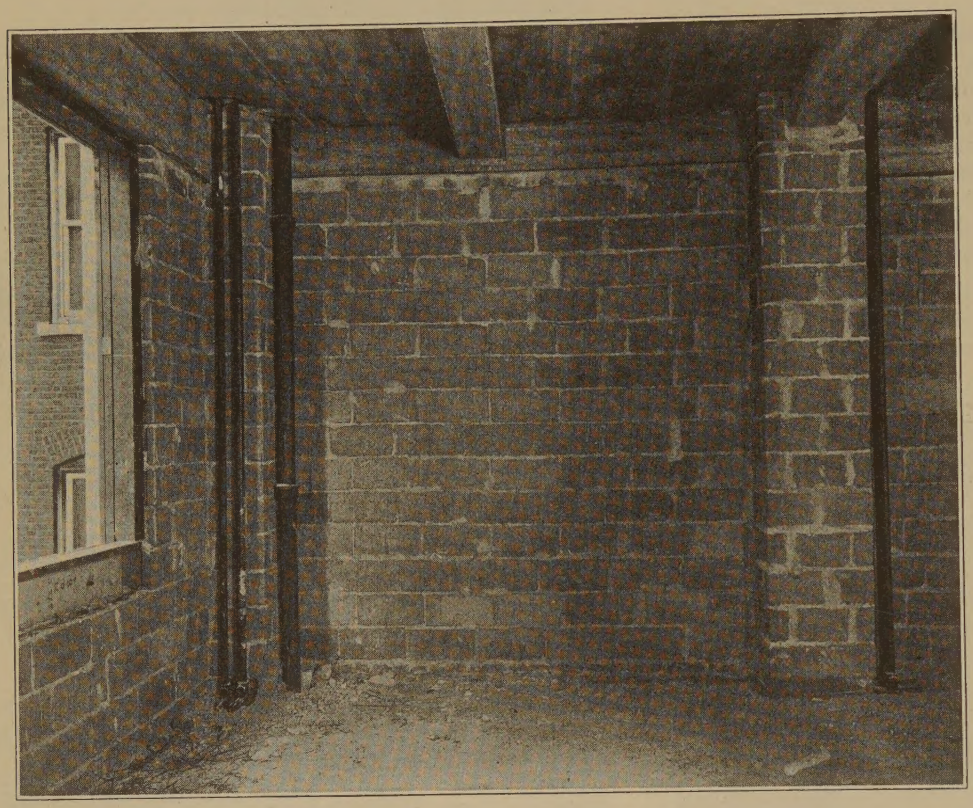
A Repeat Order

And that's not all. There is a repeat order in this story. The Fuller Construction Company, general contractors for the Integrity Trust Building, are entirely satisfied with the quality of the product and the service that is being rendered in connection with their delivery. This had much to do with the fact that the Bouvier Apartments, a 23-story structure which will soon be built in Philadelphia by the United Engineers and Constructors, will also have concrete masonry back-up and steel fireproofing, to be delivered by the Philadelphia Partition and Building Block Company.

Precedent for Skyscraper

A. H. Lavalle of Springfield, Mass., is the architect on the Integrity Trust Building. J. E. R. Carpenter of New York is the architect for the Bouvier Apartments.

Philadelphia has always been an important center of the concrete masonry industry and many millions of units are used annually in construction of all kinds in this region. However, it was not until contracts for these two structures had been let that concrete building units were specified for structures of greater height than ten stories. This sale establishes a precedent which, it is expected, will win wider recognition for this material wherever it is manufactured.



350,000 cinder concrete block and 1,000,000 cinder concrete brick were used in the 25-story Integrity Trust Building in Philadelphia

Another Outstanding Job

In this connection it is interesting to know that Philadelphia not only will have the first real skyscrapers in which concrete masonry is used from top to bottom but that it has the largest dwelling in this country built of concrete block and brick. This is the palatial Italian villa type of country home built for John L. Jacobs, president of the Philadelphia Paper Company, in which the equivalent of 30,000 8- by 8- by 16-inch block were used.

Picture Outlines Manufacture of Concrete Reinforcement Bars

"The Story of Rail Steel," an educational film in three reels produced by the Rail Steel Bar Association, has been released for distribution to architects, engineers, contractors, building officials, engineering students and all those interested in the relation of the steel industry to reinforced concrete construction.

The picture shows the manufacture of concrete reinforcement bars, portraying each consecutive operation from the refining of pig iron to the final use of the bars in reinforced concrete construction. A number of views of typical reinforced concrete construction projects in various parts of the country are also shown.

Builder Reviews Trends in Factory Construction

The modern type of American factory can now be built for about 23 cents a cubic foot, according to Jas. A. Burbank, vice-president of the John W. Ferguson Company. Level ground, normal foundation conditions and average equipment are assumed.

American factory structures today, he says, are mostly of reinforced concrete with flat slab ceilings, having no beams or girders, permitting uninterrupted distribution of light and low cost installations of sprinkle equipment, shafting, etc. Ceiling heights are about 12 feet; columns are usually 20 feet apart; floors are designed to sustain a working load of 125 lbs. per sq. ft.

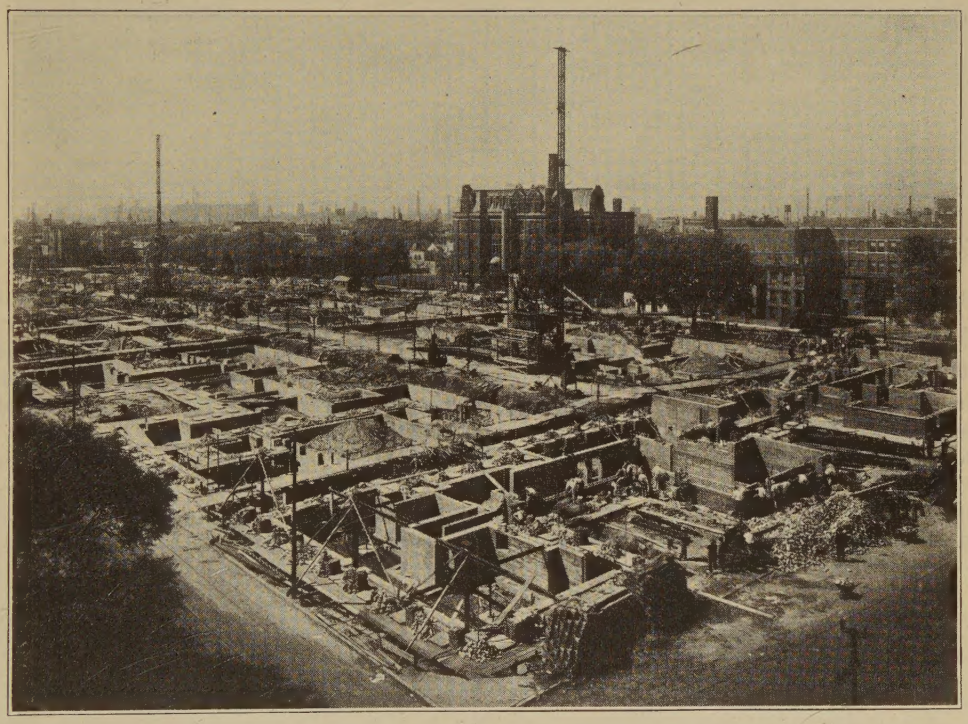
Conveying Concrete on Modern Construction Work

A Description of the Construction Methods Used in Building the Marshall Field Garden Apartments—Concrete Placed by Combination Chute and Buggy Method —Three Mixing Plants Used

THOROUGHLY modern equipment and methods for distributing concrete on a large construction project may be seen at the Marshall Field Garden Apartments, a group of ten connected five-story and basement structures covering two blocks and bounded by Sedgwick, Blackhawk, Hudson and Siegel Streets, in Chicago. The buildings have concrete foundation walls and brick bearing walls supporting reinforced concrete floors.

These apartment buildings, as the layout plan shows, consist of ten units, all of which are being constructed simultaneously. A large garage for the convenience of tenants, and a power plant to serve the entire group, will be included in the work now under construction. Gardens and playgrounds will be established within the large court, or quadrangle, formed by the buildings.

Prior to the installation of three large concrete mixing plants the foundation walls were concreted by utilizing six auxiliary mixers of Lakewood manufacture and distributing the concrete with buggies. As a result, the foundation walls were nearly completed by the time the first of the larger mixing plants was ready for operation.



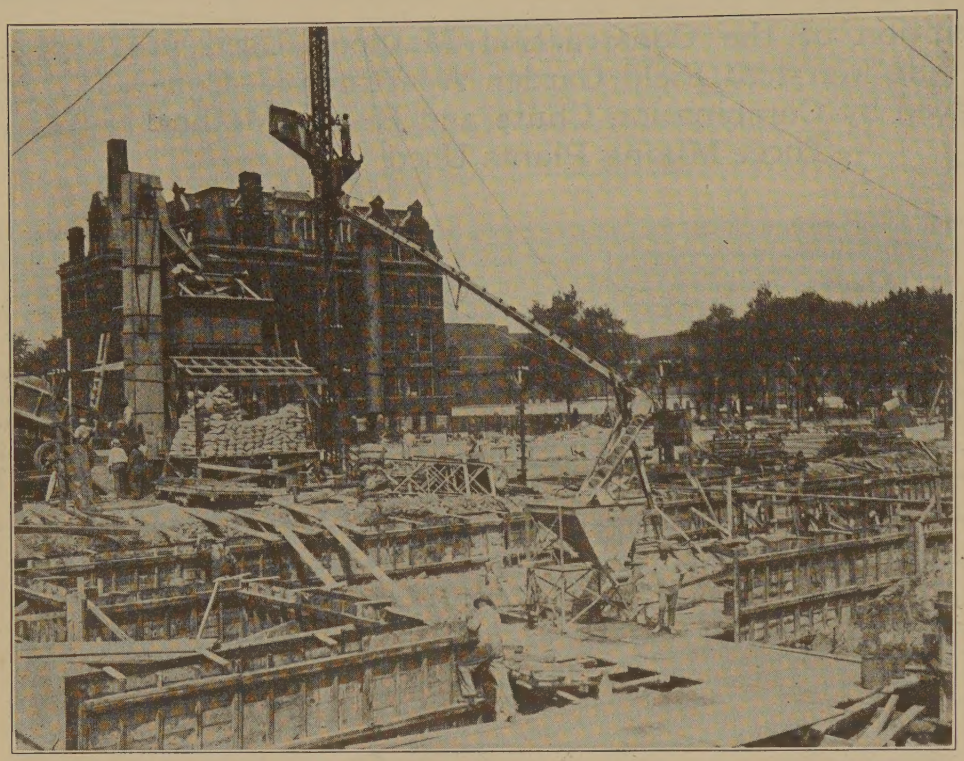
Heavy concrete foundation walls were concreted with auxiliary mixers while the 3 central mixing plants shown in this view were being installed

Plant Layout

The three mixing plants are shown in one of the illustrations, and their exact location is given in the reproduction of the ground layout of this group of buildings. Mixing plants No. 1 and No. 3 each serve three of the apartment building units, and plant No. 2 serves four units. Each of the three mixing plants consists of an Insley steel tower 120 feet high, equipped with a chain-belt conveyor. A Butler steel bin with measuring boxes for aggregates serves the mixer at the base of the tower, and a smaller steel floor hopper of the same manufacture receives the freshly-mixed concrete from the chute. The floor hopper is equipped with a device that controls the quantity of material discharged into the buggies used in distributing and placing the concrete.

An interesting part of the construction plant consists of the utilization of a concrete-paved alley, and the construction of a number of timber bridges from the surrounding streets to the alley, to facilitate delivery of material and movement of men and equipment. The paved alley formerly extended the full length of the site, north and south, from Blackhawk to Siegel Streets. Except for the space occupied by apartment units No. 1 and No. 10, the alley pavement was left intact and is kept clear of obstructions. The three main concrete mixing plants are set off to the side of the alley. At each mixing plant and at

intermediate points between them timber bridges were built in to the alley from Hudson Street on the west and Sedgwick Street on the east. Some of the bridges are of sufficient width and strength for heavy material trucks, while others were built for foot traffic and light equipment.



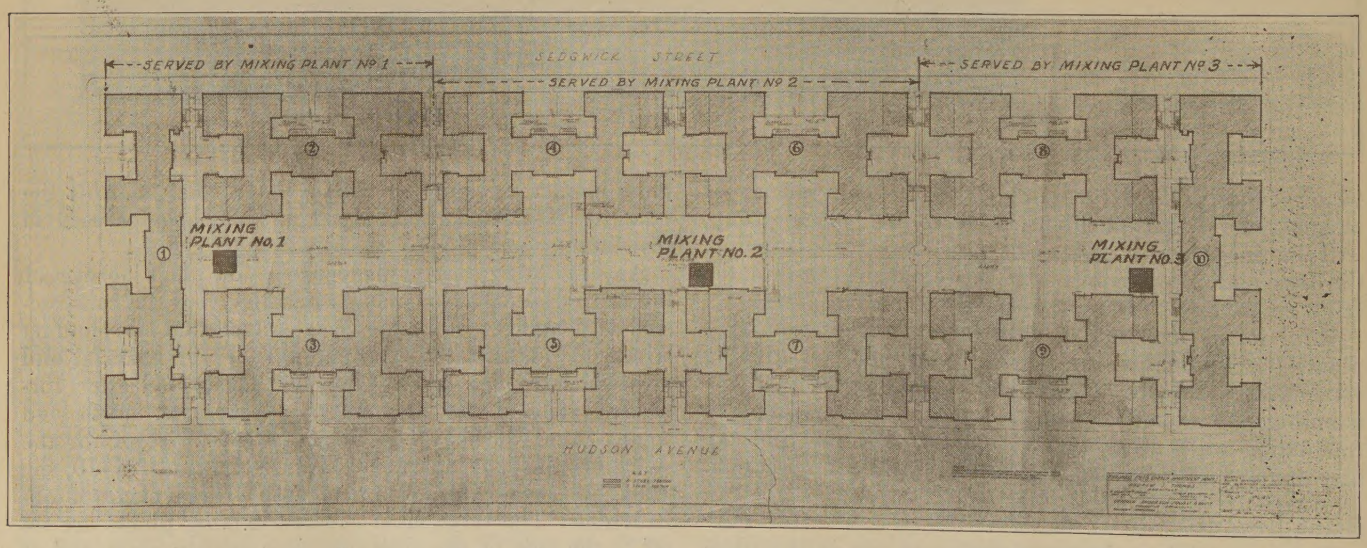
Showing one of three mixing plants and the method of chuting to a distributing hopper from which the concrete is carried to the forms in buggies

Distributing the Concrete

The method here employed in distributing concrete impresses one with the manner in which every advantage is utilized. For instance, the use of auxiliary mixers to place the concrete in foundation walls while the three principal mixing plants were being installed, the utilization of the paved alley and the construction of bridges for the movement of material and equipment, are details that disclose the hand of an experienced superintendent of construction. In its principal features, this method of distribution has become very popular on large construction projects.

This combination method of placing concrete is especially advantageous when dry concrete is specified as is the case on this job. It embodies the advantages of both the chuting method and of distribution by wheeling. At the same time it overcomes the objectionable features in both methods.

The contractor's superintendent on this job also feels that consideration must be given to the fact that spouting directly on to a thin floor section requires more labor to level the concrete than in cases where distribution is made by wheeling.

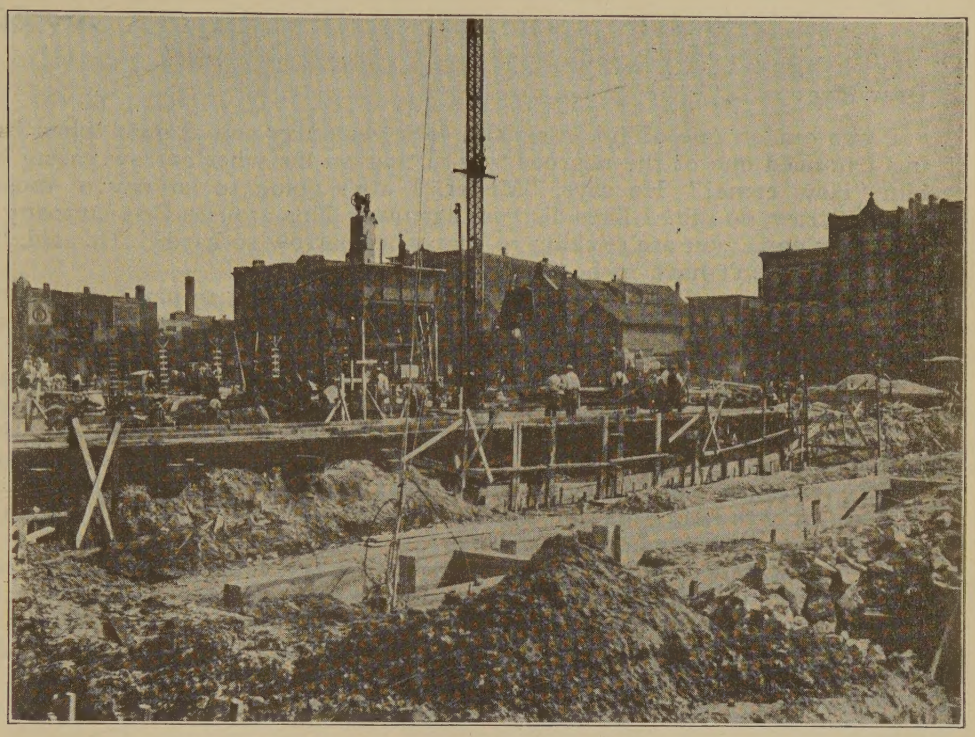


The general layout plan showing the area served by each mixing plant

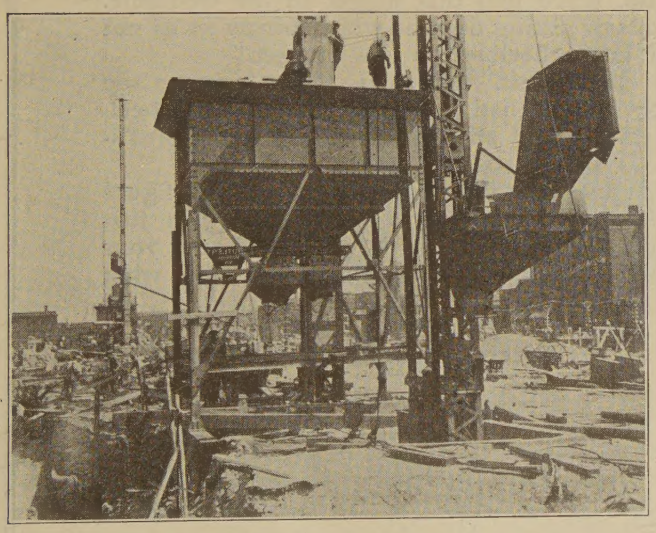
If time were not so important an element in modern construction work, concrete could be placed at lower cost by using less mechanical equipment. But the cost saved by such methods would be more than offset by the longer time required, during which the fixed overhead charges would continue.

Present methods of placing concrete fortunately have a trend toward composing the conflicting interests involved. The contractor's interest naturally requires him to place concrete with the greatest possible economy. The architect's superintendent or the engineer in charge of construction desires concrete of a strength fully equal to the strength assumed in the structural design. In designing his plant, the construction superintendent must harmonize all these requirements.

This more modern method of distribution is a happy solution of the problem, for it combines the best features of the chuting system with other methods of placing. For instance, the distributing tower remains as before. To be sure, it is a mechanical improvement over the older type of tower, but its function is the same. The distributing chutes also remain, but these have been redesigned and improved, their function consisting principally in bringing the concrete to a floor hopper on a conveniently located platform, from which the distribution can be made. Because of the short radius to be covered, the chutes may have a steep slope, so that concrete of a plastic consistency can flow in them. The concrete reaches the floor hoppers in a plastic condition and with a reasonably low water-cement ratio. From this point it is promptly distributed to its ultimate destination by methods that prevent the loss of mortar and also permit a greater measure of personal control and supervision.



One of the temporary bridges providing a roadway from the street to the mixing plant



Closeup of one of the mixing plants

The Marshall Field Garden Apartments were designed by Andrew J. Thomas, a New York architect who has specialized in housing developments. L. A. Kidd is the architect's superintendent on the work. The general contract is held by the O. W. Rosenthal-Cornell Co., of Chicago, with C. T. Montague in charge as superintendent of construction, and Emil Rosenthal as assistant superintendent. It is expected that the apartments will be ready for occupancy by April 1, 1929.

A. G. C. Meet at Minneapolis

Prevailing costs and methods of construction were studied by builders who gathered at Minneapolis, Minn., to engage in the conference which opened September 24th under the auspices of the Associated General Contractors of America.

Existing credit conditions in the construction industry and methods involved in the Mississippi river flood control work were two subjects that received attention.

P. G. RILEY
President

P. G. RILEY
GENERAL CONTRACTOR

~~701 Temple Street, Ruistown, N. Y.~~ Los Angeles

T. G. McGOVERN
General Supt.

Dear Mac:

I was out on one of Ed Wagner's jobs yesterday and at noon when Ed and I were leaving I noticed one of the negroes was sitting on his wheelbarrow eating his lunch. I asked him "How come?" He says, "Mister, I ain't going to let any of those niggers get my wheelbarrow, no sah. I likes dis here barrow." This arouses Ed's curiosity and he says, "Big boy, how come you are sticking to that wheelbarrow so hard?" He said, "Boss man, it runs easy and I don't have to be fixing it all the time."

"Say, Ed," says I, "on second thought, you are going to pay for the lunch." "What's the idea," says Ed, "are you broke?" "Nope," says I, "but after lunch I've got a hunch I'm going to save you the price of several lunches."

"Is it a deep secret or am I in on it," he asks. "You damn know you are and you are going to hire me for your efficiency expert at the price of a lunch," I answered.

So after lunch he says, "Old timer, after all that food you ate, you should do a lot of efficiency work. When do you start?" "Right now," I says, "and at your office."

When we got there I says, "Ed, I want to know when you bought that wheelbarrow that nigger was sitting on and how much you paid for it. Then I want to know what you paid for those other wheelbarrows."

He gets somebody to dig up this information and I says, "Look, Ed, this is better than I thought." "Well, Mr. Sherlock Holmes," says he, "I suppose your deductions are that the friction caused by the negro sitting on the wheelbarrow made it run easier." "Nope, Watson, you're wrong as usual," says I. "That wheelbarrow cost you $2.50 more than each of the others did." "My God, how did that slip through," said Ed, much alarmed. "Wait," says I. "It's lasted almost a third longer and is in better shape than any of the others right now."

"Now, Ed, look. You are paying that negro every day just about what the wheelbarrow cost originally." "Yep," says he, "but what's that got to do with it?"

"Nothing, you chump, only when you bought these other wheelbarrows at a cheap price you thought you saved money but you didn't see the nigger in the woodpile or rather in the wheelbarrow."

"The labor to keep those wheelbarrows running cost many times more than the wheelbarrows themselves, and if you could keep track of every five, ten, fifteen or thirty minutes spent in fixing these cheap wheelbarrows up, you'd find that nigger in the woodpile. That isn't all. The very reason for that negro we saw sitting on that wheelbarrow so as not to lose it is a damn good reason for buying the best wheelbarrow you can get."

"I can see now where you made yours," says Ed. "Wait," I replied. "You give me too much credit. As a matter of fact up until today I have had the same idea about wheelbarrows as you evidently have had. It just pays to stand off sometimes and get a bird's-eye view of your business as I am doing now."

"You kinda expect old Jim the mule to bite you and keep your eye on him, but you figure flea bites are just a part of the day's annoyances, so don't bother to locate him. But just the same the flea will bite you in more places and oftener than Jim the mule and sour your disposition in time, just as a lot of little leaks like that wheelbarrow thing will sour what should be a sweet profit."

Even Ed saw this point. Do you, Mac?

Sincerely yours,

P.G.

This is the sixth letter of a group whose publication began in the May issue of CONCRETE *written by P. G. Riley, retired contractor, to his superintendent, Tom McGovern, back home.*

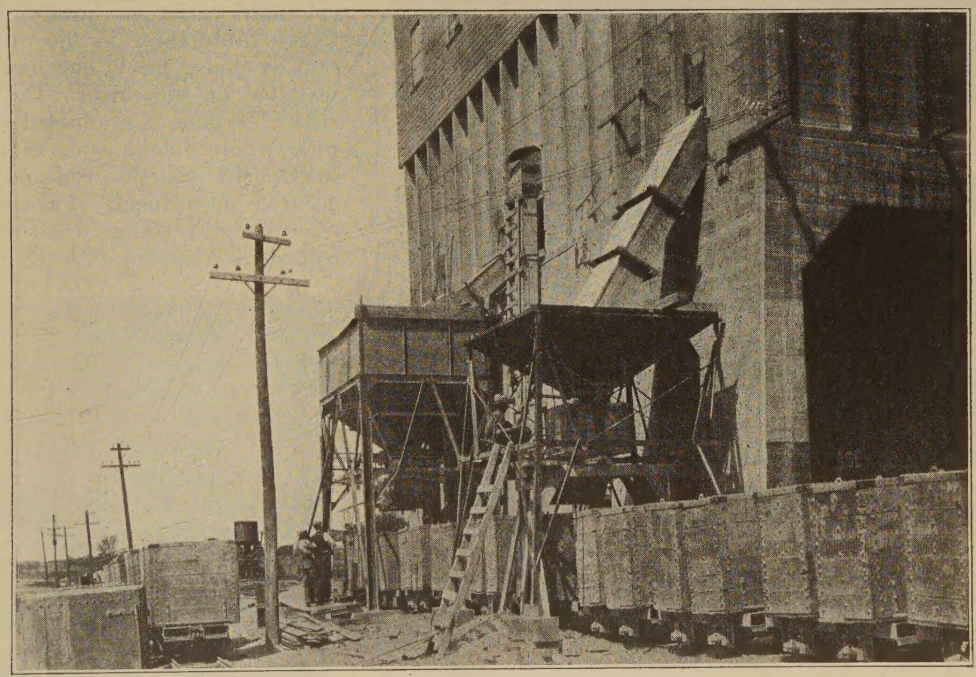
Perhaps his greatest pleasure is in keeping in touch with his superintendent and, off and on, his secretary, Anna Ryan. His being away from the scene of activity has given P. G. some new viewpoints and he manages, in his letters, to convey to the young folks some of the ideas in the back of his head.

Concrete Control on an Iowa Pavement Job

Four Sizes of Aggregate Used—Materials Measured by Weight—Water-Cement Ratio Control—Plant Arrangement—Construction Methods—Thickened Edge on Top of the Pavement—Curb Building Methods

FOUR sizes of aggregate, the accurate measurement of the water put in the mixer as well as that in the aggregate, a thickened edge on top of the pavement slab, and field laboratory control are features of the second season's experience with the measurement of batches by weight in Scott County, Iowa.

The concrete road whose construction is described runs along the west shore of the Mississippi from Davenport to the Muscatine County line. Previous construction covered the last 9.4 miles of this distance and completed the four paved highways radiating from Davenport. The slab is 8 in. thick and on comparatively level stretches is 18 ft. wide; where it is on a grade it is made 20 ft. wide and a curb 3 in. high, 3 in. wide on top and 12 in. wide on the bottom, is put along each edge. This curb holds rain water on the pavement so that it will not wash a gutter in the shoulder and also serves to strengthen the edge of the slab the same as a regular thickened-edge pavement. A longitudinal metal strip set on the center line forms a joint which cuts the slab in half. These halves are held together by dowels which also act as transverse reinforcing extending through one half-slab and across the joint.



Three sizes of coarse aggregate were taken from the quarry bins and weighed separately for each batch of concrete

Four Sizes of Aggregate Used

The limestone used for coarse aggregate was taken from a commercial quarry beside the highway. This quarry was equipped to load freight cars and had large bins holding stone of different sizes. On the side toward the highway there were chutes from the different bins which had been used to load trucks or wagons. The contractor, the Central Engineering Company, used these chutes to fill the batcher bins.

One chute discharged 1- to 1½-in. stone, another ¾- to 1-in., and the third ¼- to ¾-in. For one six-sack batch 631 lbs. of each size was weighed and dumped into the batch boxes of the industrial railway which carried proportioned batches to the mixer. Two of the sizes were weighed at one bin and the third at a bin about 30 ft. away. An industrial train would begin loading at the bin measuring two sizes of stone and slowly pull ahead until the partly loaded cars came beneath the other bin, then both batchers began dropping charges into the cars. As the cars could only be spotted under one bin at a time the weighing box at the second bin was provided with a short chute which would swing through a small arc so that stone could be dropped into the cars even though they had not stopped directly under the weighing box. This movable chute could well be put on every measuring box charging industrial cars, as it would save considerable time now lost in spotting batch boxes exactly underneath

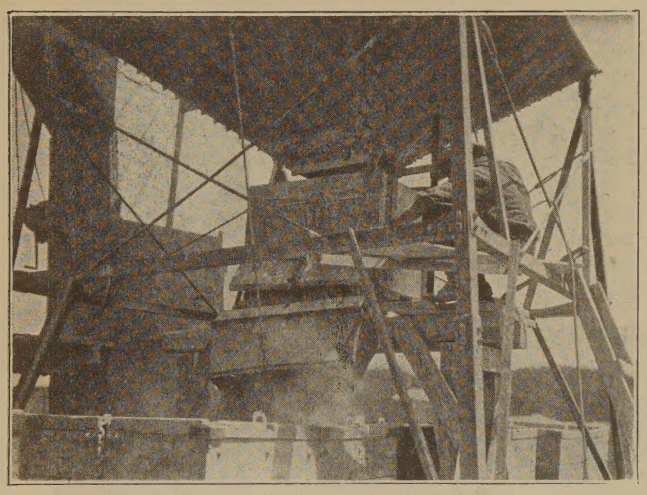
discharge chutes.

Cement was stored on a long platform between the standard gauge and narrow gauge tracks. Sand was weighed at another batcher bin to which it was lifted from cars or storage pile by a locomotive crane.

Proportioned by Weight

Proportions are specified by weight—1 lb. of cement to 1.71 lbs. of dry sand and 3.47 lbs. of dry stone. As these materials were never actually dry when weighed it was necessary to determine the moisture they contained and correct the batch weights accordingly. The moisture content was found by the plant inspector who selected samples of the materials, weighed them, then dried them to constant weight over a little oil stove which was part of his equipment. These tests were ordinarily made two or three times a day but during unsettled weather the moisture was determined oftener. The moisture content of sand taken from a storage pile several months old ranged from 2.5 to 3.8 per cent while samples taken directly from cars showed a minimum moisture content of 3.5 per cent and a maximum of 4.2. Stone was taken from the quarry and put in the roofed storage bins as soon as it was crushed so its moisture content only ranged from 0.5 to 0.8 per cent.

The plant inspector also tested the aggregate to learn



A short movable chute under the measuring hopper made the accurate spotting of industrial cars unnecessary

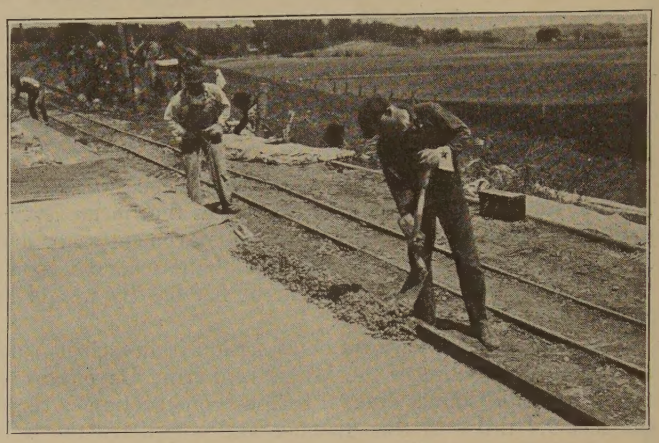
how much oversize material there was in the sand and how much of the stone would pass the ¼-in. sieve. When there were appreciable amounts of either, the batch weights were changed so that the oversize particles in the sand were counted as stone and the fines in the stone as sand.

Materials were weighed by lever scales on which the measuring boxes were hung. As the scale beam was well above the heads of the scale men the rod on which the scale weights were hung was made long enough to come within easy reach. It also carried a pointer which indicated when the scale beam was balanced.

When a batch of materials was to be weighed, the scale was first set for an amount 25 or 50 lbs. less than the true weight and materials were admitted to the weighing box rapidly until the scale beam rose. Then the scale was set at the exact weight desired and sand or stone was admitted slowly until the scale just balanced. Scalemen were required to come within 5 lbs. of the correct weight and became so proficient that they could get a batch ready in the short time required to move a car into position to receive the materials. No change of less than 5 lbs. was made in batch weights because of a variation in moisture content or sieve analysis.

Uniform Strengths Secured

During the 1925 construction season, when these methods were adopted, the strengths of 6-by-12-in. test cylinders molded daily were much more uniform than those from jobs measuring materials by volume. There was still con-



A wooden form was bolted to the steel forms to form the back of the integral curb

siderable variation, however, which it was thought was due to differences in the quantity of mixing water. To remedy this, a newly developed water measuring tank was installed on the mixer. The measuring mechanism consists of a tank, a graduated water gauge and a discharge pipe whose intake end, in the tank, can be raised or lowered by a torsion rod and crank which permits a very accurate adjustment. A correction chart showing the altered gauge readings when the mixer was on a grade or tipped by a super-elevated curve made possible the accu-

At intervals the true curb section was secured with a short template

rate measurement of the mixing water under all working conditions.

Curb Construction

The low, flat curb was built without using any face forms. The finishing machine first struck off and tamped the full width of the 20-ft. slab just as though no curb were to be put on. Then a wooden 2-by-3 back-form 10 ft. long was bolted to the steel forms through three holes drilled in the top flange of each section. The bolts were

fastened to the wooden strip so they could not fall out when the 2-by-3's were carried ahead and the nuts were put on the under side of the flange. As they did not need to be very tight the nuts were turned up with the fingers.

Concrete for the curb was carried back from the mixer in shovels by from four to six men. The curved curb face was made by first getting the proper section at certain points with a short template, then using those correct sections as a guide on which to rest the ends of a straight edge which struck off the intermediate concrete. The curb

A uniform curb face was secured by striking it off with a straight edge

was shaped with a curved metal trowel and smoothed with a wooden hand float. Tool marks were removed with a calcimine brush.

Two finishing machines were used, one for the 18-ft. slab and the other for the 20. These were followed by a longitudinal float operated from two connected wheeled bridges which ran on the forms, two floats about 4 ft. long, with long handles, and two belts.

As soon as the final belting was completed the pavement was covered with strips of burlap whose ends had to be folded back so the curb could be built. Narrow strips of burlap were laid longitudinally on the curb. After the pavement and curb had hardened sufficiently they were covered with earth which was kept wet 18 days.

Batching aggregate by weight has proved exceedingly successful in Iowa. It pleases both the contractor and the engineer; the former because it eliminates all losses due to bulking of moist sand and affords him an accurate check on the quantity of materials he has received; the latter because it produces uniform batches, more uniform strengths and consistencies which make a smooth riding surface easy to attain.

Second Annual Road Show to Open in Mexico

October 3rd will see the opening of the Second National Highway Congress and Exposition of Mexico, in Mexico City. It will continue to October 6th. The American Road Builders Association, through its Pan-American division, is taking part in the event. President Compton, the executive committee, several directors, and numerous members of the association will attend.

The congress is held under the auspices of the Mexican Federal Highway commission. Octavio Dubois, chairman of the commission, is president of the Pan-American division of the American Road Builders' Association. President Compton will present Commissioner Dubois with the certificate of presidency of the division in the first session of the congress, which General Calles, president of Mexico, will open.

Over 50 manufacturers of road building equipment, mostly American firms, will utilize 120,000 square feet of space for exhibiting and demonstrating their products.

Several Central and South American countries will be represented by delegates.

Reduced railroad fares will be in force and special rates have been granted by the leading hotels. The commission has planned special entertainment features for all who attend from the States and opportunities will be had to see many of the picturesque and interesting places near Mexico City.

The Congress will be opened by President Calles, who is deeply interested in the construction of a road system in Mexico, which will not only connect with the United States system, but will form part of the Pan-American Highway system. Several interesting papers will be presented, accompanied by moving pictures.

August Construction Reaches New Level for That Month

June of this year was the only month on record during which a greater volume of work was handled than during the August just past, according to Associated General Contractors of America statistics. A new record for August activities was thus established.

The total volume of construction registered for the first eight months of this year is more than 2 per cent greater than the figure recorded for the corresponding period of 1927, according to the same source.

The F. W. Dodge Corporation's report, on the other hand, is that construction contracts to the amount of $516,970,200 were awarded last month in the 37 states east of the Rocky Mountains. These states include about 91 per cent of the total construction volume of the country. The total of the contracts, it is said, is 11 per cent below that for July, 1928. The decrease from August of last year was about $35,000,000, or 6 per cent. There is, however, an increase of 6 per cent in construction since the first of the year over that of 1927.

The A. G. C. observes further that indications that no radical slackening of construction operations will take place during the weeks of the immediate future are being drawn from reports of record-breaking awards of contracts. The volume of contracts awarded during July was the greatest noted for that month in any year on record. The total volume of contracts awarded during the first seven months of this year, it continues, is ten per cent greater than the total gained during the same period of 1927.

Teachers Taught Concrete-Making Principles

Faculty and staff members of engineering colleges and laboratories throughout the country attended a course in design and control of concrete mixtures at the University of Pennsylvania, Philadelphia, September 18th to 21st. The Portland Cement Association sponsored the course.

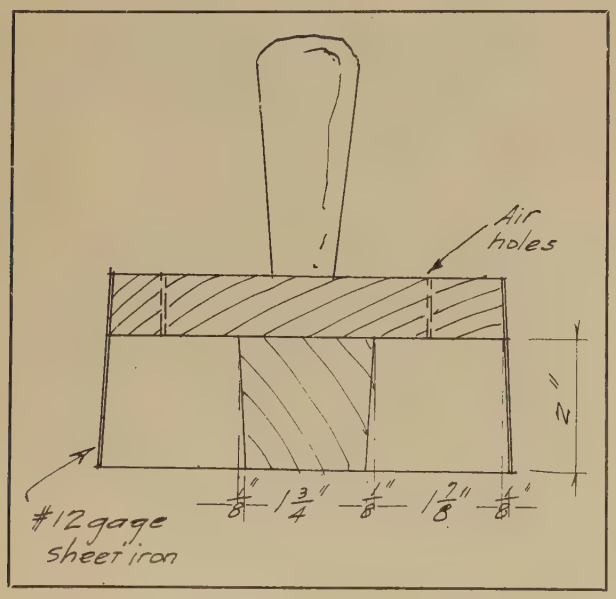
The course consisted of two three-hour sessions daily. Included on the program were H. C. Berry, professor of materials of construction, University of Pennsylvania; William H. Gravell, consulting engineer of Philadelphia; V. L. Johnson, architect, Philadelphia; J. A. Turner of the Turner Construction Company, Philadelphia; H. F. Gonnerman, manager of the research laboratory, and J. W. Kelly, R. S. Phillips, L. H. Doane and L. E. Andrews, engineers of the Portland Cement Association.

Practical Kinks from the Job

Accurate Placing of Vertical Bars by Means of Concrete "Doughnuts"

Careful observation of concrete structures which show discoloration and spalling due to rusting of reinforcement has indicated that in the majority of cases the trouble is due to the vertical column bars which have either been carelessly placed in the first place, or, having been properly located in the forms, have been displaced during the concreting operation.

A covering of 2 inches of concrete is usually considered as the minimum protection for reinforcing steel in columns exposed to the weather. Some contractors make up the exterior column reinforcing, or "cage" as it is sometimes called, on the last floor concreted and set it in place in the column form before the column form is closed up. Other contractors make up the cage on the floor forms after the column forms have been closed up and the floor forms placed in position. In this latter case it is particularly difficult to get the reinforcing truly vertical in the



column form, particularly if the story heights are excessive. If care is taken after the cage has been dropped into the form to see that it is two full inches away from the forms on all sides, and it is then carefully anchored in place by wires running back to nails driven into the floor forms, good results can be obtained, but the method of using "doughnuts" on the vertical column bars has been found simpler and just as cheap.

A "doughnut" is a simple ring of concrete, the thickness of the rim of the doughnut corresponding to the distance that the steel is to be kept away from the column forms. Figure 1 shows the form or mold for a doughnut intended to hold the column steel 2 inches away from the forms.

The method of making the doughnut is very simple. A metal form is made as shown in the sketch and fitted with a handle. A laborer is detailed to the job of doughnut making and given an old form panel or a run panel set on a pair of low horses as a work bench. Concrete is usually a 1:2 sand and cement mix, of the consistency of the concrete used in the so-called dry-tamp block process.

The method of operation follows: The mold is taken in the left hand, turned open end up, and with the handle resting on the table for support, the mold is packed full of concrete and smoothed off with a wall scraper or similar tool. The mold is then turned over either on the table, if the table is large enough, or on some plank laid nearby, and the concrete released by a gentle tap. Unless the air holes in the top of the mold are kept open difficulty will be experienced in getting the concrete out of the mold satisfactorily.

A good live man can make several hundred per day.

When the column bars are laid out on the horses ready for the steel gang to put on the hoops or bands and wire them in position, two or three doughnuts are slipped onto each corner bar, and set so that one will come near the top of the column, one near the bottom of the column, and one somewhere near the middle. The idea in using three doughnuts per bar is to be sure that enough will survive the rough handling that the cage gets in being lowered into place to hold the column reinforcement firmly where it belongs.

Inasmuch as the doughnuts are circular, they only touch the wood forms with a knife edge, and as a result they do not show on the face of the column after the forms are taken down.

The covering required for column bars is usually the same for all the columns throughout a building, so that only one size doughnut need be made.

Handy Tape Spike

The photograph shows a very handy tape spike made from a discarded valve of a Ford motor. It is very convenient for those times when one must use the line alone, or does not wish to bother others for assistance. A downward notch cut in the stem with a hacksaw keeps the line eye from slipping down. As there is some pretty

fair metal in the stems, the point will stay sharp for a long time. The valve seat makes a handle which enables the point to be easily forced into ground, wood, between soft brick, and about every other place a location might be desired. The old valves, needless to say are very easy to procure.

EDITORIAL

Conveying Concrete

ONE of the concrete contractor's most important problems on any given job is the determination of the most economical method of conveying his concrete from the mixer to the forms. In these days of stiff mixtures, another element is added to the problem.

Contractors have been accused of showing little ingenuity or originality in the methods used, in spite of the fact that every job presents its own problem in plant layout, and selection of equipment. This accusation is deserved less today than in previous years. An examination of the articles published in this issue will reveal the use of three different methods on the three construction projects described—the use of the belt conveyor; the use of the combined method of chuting to a central hopper and distributing by buggies; and the use of motorized dump bodies. It is noteworthy that each of these jobs developed concrete that more than met specifications as to quality.

It is not necessary that any one method of conveying concrete be required for placing present-day controlled concrete. The fact that drier mixes are now being used does not limit the contractor's choice of plant layout or equipment. He may exercise his ingenuity to the fullest extent, for quality concrete has been and can be placed with a wide variety of plant layouts.

The National Products Association

ON other pages of this issue will be found some recommendations for increasing the value of the service that the national concrete products association can render its members. These suggestions, made by progressive concrete products manufacturers who have themselves taken an active part in the affairs of the association, deserve the careful consideration of every products manufacturer who is interested in the welfare of his industry.

Recently, in conversation with a man who is in close touch with the concrete products industry, the statement was made that the concrete products manufacturers are not yet ready for co-operative work. There was still so much that the individual manufacturer needed to do in his own business that he could not yet realize the advantages of co-operative effort, such as is made through an association.

This statement is undoubtedly true as it refers to a great number of products manufacturers. But it is also true that there are some who have already set their own houses in order and who are now ready to take the step toward co-operative effort.

The question is: Are there enough of these to warrant the continuation of a national concrete products association and are they interested enough to give the time and effort needed to make such an organization an active force in the industry?

The manufacturers who comment on this question in this issue answer these questions in the affirmative. They feel that not only should the work of the national concrete products association be continued, but that it should be expanded. To do this most effectively, they recommend changes in the form of organization.

Perhaps the program suggested will enable the association to do more effective work. Further discussion of this question is invited to the end that ideas on the matter may be fairly well crystallized before the next meeting of the association.

Influence of Central Mixing Plants

CENTRAL mixing plants can further the cause of quality concrete or they can hinder it, depending on the business principles of the men who own and operate them.

When such plants are operated by men who know the fundamentals of making good concrete and who are determined to build their business on the principle of delivering only quality concrete, they are an influence that will work for the good of the concrete industry in their communities. If, on the other hand, central mixing plants are operated by men who have a political "drag" and who are indifferent regarding the quality of the concrete they turn out, they can do much to harm the industry.

It has been suggested that one way to assure the use of better concrete on the many small foundation jobs was to include a clause in the city building code, specifying that all concrete be taken from a central mixing plant. Such a provision would gain its objective if the city's central mixing plant were free from political influence and it would defeat its purpose if the concrete taken from a plant were no better than that now being used.

Fire Prevention Week

THIS year fire prevention week has been proclaimed for October 9th to 13th. Because public attention will be directed at this time to the great losses incurred from the ravages of fire, this is an especially good time for concretors to exploit the fire resistive qualities of the material they work with.

Tests of the most severe kinds have shown that reinforced concrete and concrete masonry construction are fire resistive to a high degree. During that week, when attention is focused on fire prevention, concrete contractors and concrete products manufacturers are given an exceptional opportunity to tie up their advertising with a nation-wide campaign.

From the Products Associations' Bulletins

Iowa Concrete Products Association

R. L. GAVIN, Secretary-Treasurer

THE Iowa association starts off its September "Concrete Products News" with a page on "Better Quality and Lower Price," quoting Ray M. Hudson of the Department of Commerce.

The latter says, in part, "Simplification is likewise contributing to this end (quality improvement). Concentration of effort on a simplified line often makes it possible to improve the quality of a product. Defects, even minor faults, which in the days of too many lines, short runs, and frequent changes of machine set-ups, were overlooked, are emphasized by reason of their proportions even though the frequency of their occurrence may be no greater than before.

"But when units are made by the thousand instead of by the hundred, then the 'seconds' make a larger pile and attract more notice. Someone gets curious, somebody wants to know why the pile is so big. Then corrections begin. Maybe better raw material is bought, more care is given it in process, perhaps the machines are improved. Eventually the cause is located and the frequency of the defect is cut down. Product quality is improved as the result of simplifications. So far as simplification has coincidently helped to make mass production possible and thus lower unit costs, it has made a double contribution."

Midway in this letter to Iowa products association members, its writer waxes somewhat idealistic, saying, "Let's be a little more friendly. Let's do a little more for others and by doing, get a little more for ourselves. Let's not bother to hate anyone. Not even the rude buyer who slams the door in our faces. Let's be thankful we are salesmen. Let's feel 'good will' toward our jobs in particular and the business as a whole, for we have the opportunity to learn, to expand, to develop, to create, and we truly can get much out of life."

Under the heading, "New Booklets Available," attention is called to Portland Cement Association publications of which the products manufacturer can make good use, if carefully distributed wholesale. "A clay tile man," the editor says, "told me recently that if his organization had the booklets available that ours has, he would run all competition out of the field in no time."

"News from our members" includes an item reporting the visit to the association offices of one member who "reports business rather quiet in his territory but hopes to see considerable improvement in his farm trade this fall. He has started a small advertising campaign on his concrete vaults and has already received some encouraging inquiries."

Another concerns the new home of the association president, Geo. T. Wilhelm. "Naturally concrete block, roofing tile and trimstone are the predominating materials, proving beyond a doubt that George is sold on his own products."

Wisconsin Concrete Products Assn.

JACK FRANKLIN, Secretary

WISCONSIN members who have been most active in the work of the group probably found no little gratification in the welcome words contained in the association's Weekly Letter No. 12. In it Secretary Jack Franklin tells of his finding, on a trip through eastern states, of the reputation for leadership that the Wisconsin association has established for itself among similar groups.

The secretary speaks wisely when he says "It is not without a great deal of effort that we have reached this position.

"But let's not get 'cocky' and rest on past glory. Let's all keep working together for the common cause."

In an earlier but recent letter entitled "Publicity" the membership is reminded of the value of news stories on concrete products in local papers. Those who have had experience in that direction will agree, that "You will find the editor ready and willing to co-operate when it comes to telling the public of some unusual feature that you have in your plant or something new or unusual about a particular job which you are furnishing at the present time."

Continuing, the letter says, "If you have a job in which an unusual number of units are being used, or in which they are laid up in some way not common practice in your community, you should see your editor and tell him about it. It isn't necessary to write the story yourself, but tell it in an interesting way to the editor so that he may make a news item of it. You will be surprised how many people read articles of this sort about your product, when connected up with an occasional page advertisement in the same paper." Then follows an offer of help from the association in working out the news angles of it.

Northwest Concrete Products Association

F. R. ZAUGG, Secretary

"HOW Many Products Men Play Golf?" the "Precast Product" questions in its September issue, enlarging as it applies to its own members the subject originally brought up by the "Wisconsin Concrete Products Digest."

A letter reprinted in this publication and worthy of repetition is that mailed to a number of councilmen in a locality where a sewer job was soon to be up for bids and which the Grays Harbor Cement Products Company is said to have found very effective.

"Supposing you were sitting in your car at the railroad crossing awaiting the passage of a freight train of 86 cars. It would be a long wait and you would admit—some train.

"Knowing that each of these cars was loaded with 26,000 pounds of concrete sewer pipe, you would have to admit that the use of so large a quantity of this material in so small a community as Hoquiam and Aberdeen, recognizes its suitability for use in sanitary sewers especially if you knew that some 500 cars of concrete sewer pipe had preceded this in the same community in the past eight years. We now have on file and are furnishing concrete sewer pipe on orders totaling over 1100 tons or 86 carloads.

"We hardly think you would believe the city engineers and councilmen of these two cities fit subjects for the insane asylum because they prefer or at least accept concrete pipe on a par with competing materials. Knowing the history and use of well made concrete pipe and its satisfactory service in practically every city in the United States, these men have a well deserved confidence in concrete pipe."

"Grays Harbor Cement Products Co."

Painless Bookkeeping For Products Plants

The First Article of a Series on a Simplified Method of Keeping Products Plant Records — Production Records Are Discussed in This Article

By F. W. SCHNOEBELEN

Part I—Production Records

The production end of the business of manufacturing concrete products will be discussed in this, the first article of a series on simplified records. The necessary records for one month's operation will be compiled and analyzed.

In the second article sales records will be studied and simple forms for keeping such records will be shown. We will then discuss the bookkeeping records from which we will make a complete study of a month's business. A classification of accounts for a concrete products business with a numbering scheme and a posting chart will also be presented.

When every type of transaction for a month's business has been recorded, it will be shown how each operation interlocks with other operations, the books will be closed, a profit and loss statement taken and a balance sheet made.

From this information a cost sheet will be laid out which will enable you to analyze every item of cost entering into the finished product. This is the basis on which you must fix your selling price if you want to show a profit.

THE first requirement of any record is accuracy. Guesswork or approximate tabulations should have no place on our records, if the information that they are to reflect is to be of any value to us. But accuracy alone will reveal little, if the method of tabulation is wrong. That is, our records may be correct as far as the figures are concerned, but if they will not tell us the story of our business, they are of little value.

Some of us don't keep enough records, while others, on the other hand, burden ourselves with a great deal of unnecessary work. We laboriously fill out a large number of forms which after all reveal very little information.

In this article we will study those records absolutely essential for an intelligent understanding of the production end of our business. Only four forms—The Daily Time Sheet; The Pay Roll Time Sheet; The Daily Production Sheet and The Monthly Production and Perpetual Inventory Record—are necessary. All of these are simple in design and easily understood. Yet they contain a surprising amount of information.

Exhibit A.1
THE STANDARD BLOCK CORPORATION OF AMERICA
THE DAILY TIME SHEET
Date - January 2, 1929

		Time Work						Piece Work						
Employee No.	Name	Productive Hours	Non-Productive Hours	Total Hours	Rate-per-Hour	Amount Earned Time Work		Machine Number	Operating Hours	Total Units	Rate per-Unit	Machine Earnings	Amount Earned Piece Work	
1	John Smith		10	10	$1.00	$10.00	✓							
8	B. Brown							1	10	700	$.02	$14.00	$7.00	✓
11	R. Johnson							*	10	*	*	*	7.00	✓
12	John Doe	6	4	10	.55	5.50	✓							
13	F. White							3	10	560	.02½	14.00	7.00	✓
14	W Work							*	10	*	*	*	7.00	✓
16	G. Gray	10		10	.60	6.00	✓							
19	Tom Jones	1		1	.70	.70	✓	5	9	40	.15	6.00	6.00	✓
	Totals	17	14	31		22.20			49				34.00	

The Daily Time Sheet

Exhibit A.1 is The Daily Time Sheet. The headings used are largely self-explanatory. It is helpful to give every employee a number when he begins his employment at the plant, for it saves time and space in the records. Under the heading "Name," we should write the name until we associate it with the employee's employment number. After that it will be unnecessary to write it on this particular form.

In progressive plants of today men are employed on both time and piece work. The combination of the two results in a saving in the labor costs. This feature will not be discussed in this installment; it is mentioned only to explain the headings Time Work and Piece Work. Under the main heading "Time Work" there are a number of sub-headings. "Productive Hours" represents time devoted to the actual manufacturing of the product. Under this heading the time of machine men, mixer men and those engaged in the handling of the raw materials and the finished product is recorded. "Non-Productive Hours" represents time devoted to the maintenance of the buildings, machinery or any other general labor not connected with manufacturing. We also list under Non-Productive Hours the foreman or supervisors that are not physically engaged in manufacturing. Under "Total Hours" we place the sum of the productive and non-productive hours for the day. An employee may be engaged in manufacturing work part of the day and then placed on some repair work, such as employee No. 12 on Exhibit A.1 who put in 6 hours of productive and 4 hours of non-productive labor. "Rate Per Hour" is self-evident. "Amount Earned

Exhibit A.2

THE STANDARD BLOCK CORPORATION OF AMERICA.

PAY ROLL TIME SHEET

For Period, *January 1, 1929* to *January 8, 1929.*

No Employee	Name	Class of Work	Sun. 1	Mon. 2	Tues. 3	Wed. 4	Thur. 5	Fri. 6	Sat. 7	Amount Time Work	Amount Piece Work	Total Earnings	Drawings	Net Earnings
1	John Smith	Time Work		$10.00						$60.00		$60.00		$60.00
		Piece Work												
8	B. Brown	Time Work										$50.00	$20.00	$30.00
		Piece Work		7.00							$50.00			
11	R. Johnson	Time Work										$36.00		$36.00
		Piece Work		7.00							36.00			
12	John Doe	Time Work		5.50						$20.00		$30.00		$30.00
		Piece Work									10.00			
13	F. White	Time Work								$10.00		$31.00	$15.00	$16.00
		Piece Work		7.00							21.00			
14	W. Work	Time Work												
		Piece Work		700										
16	G. Gray	Time Work		6.00										
		Piece Work												
19	Tom Jones	Time Work		.70										
		Piece Work		6.00										

To be filled in daily.

Time Work" is the amount due the employee for time work, which is the total hours multiplied by the rate.

Under the main heading Piece Work, we also have a number of sub-headings. "Machine Number" is the number or the type of machine used. "Operating Hours" represents the number of hours that the machine was in use during that day. "Total Units" represents the number of units produced on the machine for the day. "Rate Per Unit" is the amount paid to the operators for each unit. "Machine Earnings" is the total amount earned on the machine by the operators for the day. If more than one employee works on the one machine, this amount must be divided in proportion to the number of operators, which divisional part is placed in the column "Amount Earned Piece Work." For instance on Schedule A.1, employees No. 8 and 11 were operating machine No. 1, working 10 hours, producing 700 units at 2 cents per unit, making the machine earnings $14.00. This amount must be equally divided between two operators, $7.00 each, which amount is extended to the Amount Earned Piece Work column.

There are times when an employee will work both time and piece work on the same day. This is illustrated in the case of employee No. 19, who put in one hour of time work at 70 cents per hour, which amount is placed in the Amount Earned Time Work column. This same employee also put in 9 hours on a machine, producing 40 units at 15 cents which is $6.00, the amount placed in the Amount Earned Piece Work column.

The Foreman fills in the columns headed "Productive Hours," "Non-Productive Hours," Employee Number, Machine Number, Operating Hours and the Total Units. The balance of the information such as the rate and amount earned is filled in by the timekeeper at the end of the day.

The columns Productive Hours, Non-Productive Hours, Total Hours, Amount Earned Time Work, Operating Hours, and Amount Earned Piece Work should all be footed and the totals placed at the end of the columns. These totals are used as a check. For instance, the sum of productive and non-productive hours must equal the total hours' time work. The information tabulated also shows the number of productive and non-productive hours for the month or year. The balance of the totals, Amount Earned Time Work and Amount Earned Piece Work will be used in checking the pay roll for the period, which will be explained in Exhibit A.2. The Daily Time Sheet which is of convenient size (8 in. by 10 in.) should be filed after all postings have been made.

Pay Roll Time Sheet

The Pay Roll Time Sheet (Exhibit A.2) is a record that tabulates the amount each employee earns daily for a convenient period of time. In order to save time, we generally pay employes once a week or even once in two weeks, which we call a pay roll period.

In Exhibit A.2, the pay roll period is for one week, January 1 to January 8. Here again the number of the employee is in the first column with his name in full in the second column. Under the heading "Class of Work"

we have two horizontal spaces for each employee, the upper one for the amount earned "Time Work" and the lower for the amount earned "Piece Work." We then have seven columns, one for each day in the week, and numbered to conform with the date. The timekeeper posts from the Daily Time Sheet (Exhibit A.1) the amount each employee earns. For instance, employee No. 19 on the Daily Time Sheet shows an earning of 70 cents time work and $6.00 piece work. These amounts are posted to No. 19 on the Pay Roll Time Sheet in the column headed Monday 2 after Time Work and Piece Work respectively. After the posting has been completed, it is checked by comparing the daily totals in the Daily Time Sheet with those of the Pay Roll Time Sheet. That is, the sum of the totals in the Daily Time Sheet which is $54.20 is equal to the January 2 column in the Pay Roll Time Sheet. The posting is then assumed to be correct.

At the end of the pay roll period, we add the amount of time work per employee and place it in the total Amount Time Work column and in like manner the piece work and place the total amount in the "Amount Piece Work" column. We then place the sum of the total "Amount Time Work" and "Piece Work" columns in the Total Earnings column. If an employee draws during the week, this amount is placed in the "Drawings" column. The "Net Earnings" for the period is the difference between the total earnings and the drawings. For instance, employee No. 13 earned for the period $10.00 time work and $21.00 piece work, the total earnings being $31.00 less $15.00 drawings leaving $16.00 the net amount due at the end of the pay roll period. From the net earnings

Exhibit A 3

THE DAILY PRODUCTION SHEET

Date. *January 2, 1929*

No. of Machine	No. of Employees.	Description	Number of Units		Bags of Cement	Yards of Material
1	8 & 11	8x8x16 Plain Blocks	700	✓		
2						
3	13 & 14	8x12x16 Plain Blocks	560	✓		
4						
5	19	9x12x12 Pier Blocks	40	✓		
		Cement			102	
		Sand and Stone				28.

Remarks: 1 - Order a car of facing sand. (low)
2 - No. 16 was employed repairing Machine No.2.
3 - No. 12 has requested a increase in pay, please let me know on this as soon as possible.
4 - Order piece No. 3HX. on Machine No.2.

Signed. *John Smith.*

at the end of the period, the vouchers are made out for the employees. The Pay Roll Time Sheet should be in book form, the size of the sheet being 14 in. by 14 in.

Daily Production Sheet

The Daily Production Sheet (Exhibit A.3) is a form that is entirely filled out by the foreman at the end of the day. The heading is self-explanatory, being similar to the Daily Time Sheet. Under the heading "Machine," its number or type is filled in. In the "Number of Employees" column we place the number of the machine operator. Under "Description" we list the size and the kind of the unit made on the machine. "Number of Units" represents the number of each size unit made on the machine. Under "Bags of Cement" and "Yards of Material" we place the total material used for the day. If your records are such that you know the amount of materials used on each machine, then it is best to list them separately in order to make a closer check on operations.

At the bottom of the sheet there is a series of blank lines that may be used by the foreman for various things, such as requisitions, recommendations and detail explanations of production. By watching the Daily Production Sheet the manager may scrutinize the working of the plant and have a complete check on his production, labor and raw material without any effort. The Daily Production Sheet should be printed on thin cardboard sheets—size 7 in. by 8 in. which makes them easy to handle. These cards should be filed for ready reference.

Monthly Production and Perpetual Inventory Record

The Monthly Production and Perpetual Inventory Record (Exhibit A.4) is a means whereby each particular kind of unit is listed separately each day and at the end of the month the total of each kind of unit is multiplied by its cost or inventory price to determine the inventory value. On the left hand side of the sheet, there is a list of all the various kinds and sizes of the units made, such as plain, rock-faced, pier and chimney blocks together with all the sills, caps and specials manufactured by the plant. Each operating day in the month is represented by a column headed by the date. The number of units produced each day is placed in the dated column after its particular size and kind. For instance, on January 2nd, the daily production sheet shows that 700 8 by 8 by 16 plain, 560 8 by 12 by 16 plain and 40 9 by 12 by 12 pier blocks were made. These data were posted to the Monthly Production and Perpetual Inventory Record in the January 2nd column.

By footing the column we find that our daily production is 1580 blocks of 8 by 8 by 16 plain. We arrive at that figure by changing all units manufactured into 8 by 8 by 16 plain, on a price basis. We will assume that the manufacturer has taken the 8 by 8 by 16 plain block which is by far his largest seller, as the standard unit, the selling price of this block being 20 cents. The market price of the 8 by 12 by 16 plain is 25 cents. We then multiply the number of 12-in. block, which is 560 by 25 cents which equals $140.00. This divided by 20 cents, the selling price of the 8-in. standard, gives us 700 blocks, the equivalent in 8-in. plain. In other words, take the number of each particular unit produced, multiply it by its market price and divide the product by the market price of the standard unit. This gives the equivalent in the standard unit.

At the foot of the Monthly Production and Perpetual Inventory Record, we post the number of bags of cement used for the day from the Daily Production Record and the number of manufacturing hours from the Daily Time Sheet. In order to check daily on the strength of our blocks and to see that our cement is running constant, we divide the number of units manufactured for the day (1580) by the number of bags of cement used (102) which gives the number of blocks per bag of cement (15.58). In like manner in order to determine how many blocks are manufactured per hour, which is to see if our labor cost varies, we divide the number of units manufactured (1580) by the number of hours for manufacturing (80) which gives the number of blocks manufactured per hour (19.07). If we wish, we could in the same manner find the number of blocks manufactured per pro-

Exhibit A.4

THE STANDARD BLOCK CORPORATION OF AMERICA

THE MONTHLY PRODUCTION AND PERPETUAL INVENTORY RECORD.

January 1929	2	3	4	5	27	28	29	30	Total Units	Invt. Cost	Inventory Value.
Plain Blocks											
8 x 5 x 16		600							1800		
8 x 8 x 16				1250		1200			4275	$.15	$ 641.25
8 x 8 x 16 Cor.									580	.15	87.00
8 x 10 x 16	700		700			700			7800		
8 x 10 x 16 Cor.		250	300						900		
8 x 12 x 16	560							560	2980		
8 x 12 x 16 Cor.								96	96		
8 x 12 x 8			300						600		
8 x 10 x 8									160		
4 x 8 x 16											
4 x 10 x 16				280					560		
4 x 12 x 16											
Rock Faced											
8 x 8 x 16							980		2940		
8 x 8 x 16 Cor.											
8 x 10 x 16							680	680	2720		
8 x 10 x 16 Cor.								160	480		
8 x 8 x 8									70		
8 x 10 x 8		300							600		
4 x 8 x 16								200	400		
4 x 10 x 16		160		130					290		
Pier Blocks											
9 x 12 x 12	40								120		
9 x 16 x 16			35						70		
9 x 20 x 20							40		40		
Chimney Blocks											
8 x 8 flue						200			800		
8 x 12 flue		116							380		
12 x 12 flue											
Pier Caps											
4 x 14 x 14		24							48		
4 x 18 x 18			20						80		
4 x 22 x 22		10							10		
Chimney Caps											
8 x 8 flue								21	21		
8 x 12 flue		18							18		
12 x 12 flue									6		
Foundation Blocks											
8 x 8 x 8			110						160		
Sills											
4" x 6" per foot						180			540		
4" x 9" per foot								36	36		
4" x 11" per foot				150					300		
Miscellaneous											
Wall Coping											
Ornamentals							1		1		
Specials									8		
Totals (8x8x16 Equivalent)	1580	1549	1500	1822		2050	2556	2114	37403		$4488.00
Cement	102								2505		
Blks. per bag.	15.58								14.93	Monthy -	
Hours for M'f'g.	80	(Fill out Daily)							18.90	Averages	
Blks. per Hour	19.07								19.71		

To be filled in with inventory cost price.

To be filled in as illustrated above.

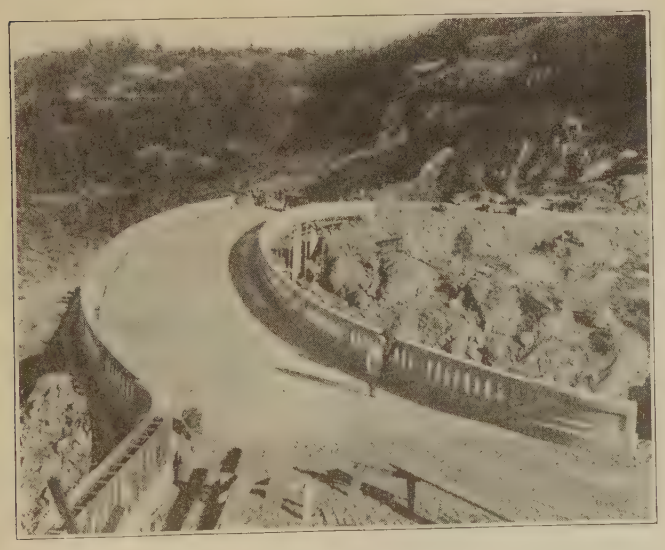
ductive and non-productive hour, by taking the time from the Daily Time Sheet. Some also prefer to figure it in terms of block per man per day. These data we fill out daily in order to watch our production closely and to make comparisons with other months or years. At the end of the month we then take a general average of the blocks per bag of cement and blocks manufactured per hour and try to keep the standard set by us through the year or to improve it.

Every concrete products manufacturer should know his loss or gain monthly, but in order to determine this he must have an inventory of his products. To take a physical inventory monthly is a great deal of unnecessary work, which can be eliminated by keeping a perpetual inventory record. This can also be kept on the Monthly Production and Perpetual Inventory Record (Exhibit A.4). Under the heading "Total Units," we list the total number of each particular kind of unit produced during the month. In the Cost column, we place the inventory value of each product. The total number of units manufactured multiplied by the cost gives our inventory value for each kind of unit. For instance, we manufactured 4275 8-in. blocks during the month of January at a cost of approximately 15 cents each, the value being $641.25. In like manner we treat every item on the list and the sum of the total is $4488.00—the total value of the products manufactured during January. We wish that you would keep this figure in mind, for we will again use it when we determine our inventory of manufactured stock for the month of January. This will be taken up when we determine our profit and loss from the month's business transactions in a later article.

(Sales records will be covered in next month's article in this series)

Concrete Bridge in Northern California Has Unusual Engineering Features

Built at an elevation of 7,000 feet, one of the most unique structures of the roads of California makes possible a grade of only 7 per cent from Donner Lake to the summit of the Sierra Nevada mountains and replaces a

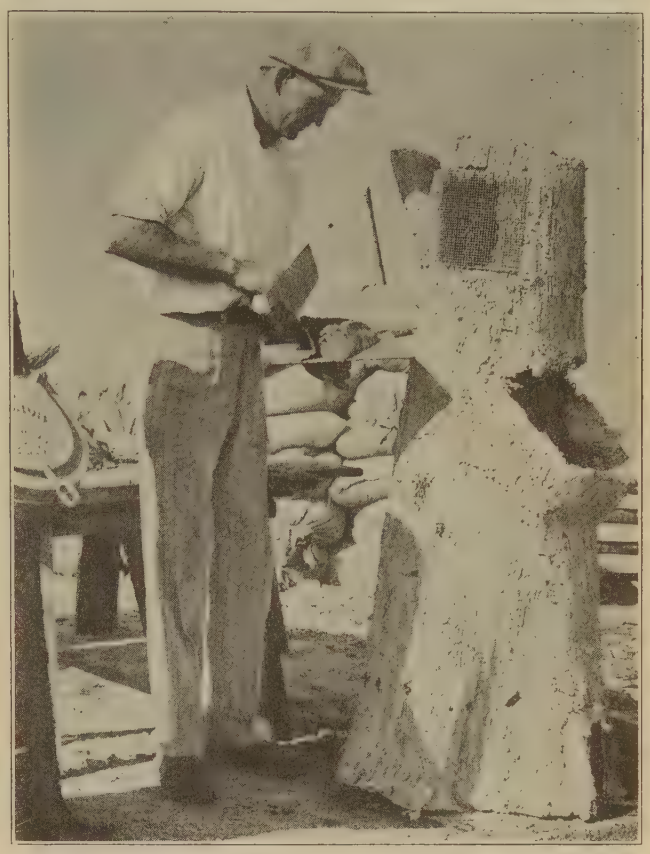


road which for years had led one to the top of the mountains over 18 and 20 per cent grades.

The bridge has an arch of 110 feet in length with a depth of 70 feet even though it is built on a compound curve and on a grade of 7 per cent. For many years this section of the mountainous roads of Northern California was the most difficult to negotiate in going to the East.

Rustic Rubbish Burner of Concrete

Outdoor concrete incinerators have found popularity in California due, perhaps, in some measure, to the rustic effects secured by one manufacturer of the specialty.



The accompanying illustrations show an incinerator in the making and the finished product installed.

A reinforcing frame of wire screen is built in the rough shape of the incinerator, with an opening for removal of ashes, charging door and a screened chimney. A hinged iron lid is provided for the charging door.

Reinforcing Institute Meets in Pennsylvania

The program of the semi-annual meeting of the Concrete Reinforcing Steel Institute, about to go into session, includes an illustrated symposium on "Unusual Construction Jobs," with talks, of 10 minutes each, by several Institute members, and a general discussion pertaining to concrete ribbed floor construction. The gathering is being held from October 1st to 3rd at Buckwood Inn, Shawnee-on-Delaware, Pa.

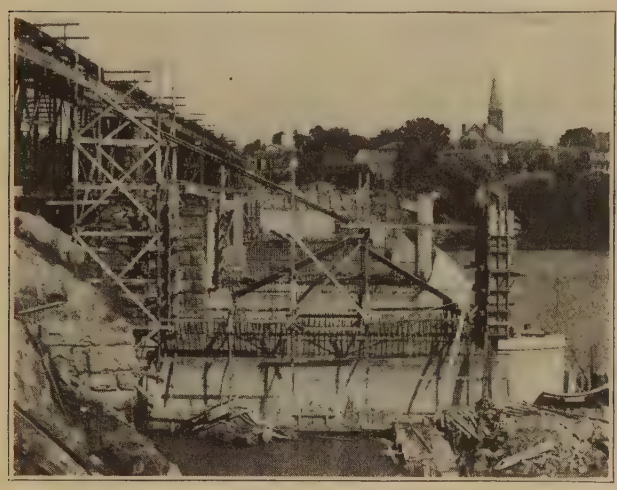
The first day will be occupied until evening, when the first session is held, by a meeting of the board of directors and regional conferences. At the opening session, following the president's address and committee reports, Chas. J. Graham, president of the Bolt, Nut and Rivet Manufacturers Association, will speak on "Constructive Selling."

On the morning of the following day will be delivered the job symposium mentioned previously, followed by an address, "Control of Selling Costs," by Walter C. Conger, vice-president of the Truscon Steel Company. At this session also, Frank Burton, former city building commissioner of Detroit, will talk on "A History of Building Codes." Regional conferences will be held in the afternoon and the semi-annual banquet that evening.

Belt Conveyor *for* New Maumee-

By S. A. Baxter
The Newton-Baxter Co., Toledo, Ohio, Contractors

Note the track under the arch rings at the pier line over which the truss units are rolled to clear the span



Looking across the river, showing the chutes that carry the concrete from the conveyor to the piers

THE construction of the new Maumee-Perrysburg bridge across the Ohio River represents in cost approximately $400,000.00 and is the largest bridge contract in the state of Ohio at the present time. Work was commenced September 15, 1927, suspended temporarily during winter weather and resumed early this spring. The progress made to date has been chiefly due to the belt conveyor system for depositing concrete and the system of steel truss centering used for the forming of the arch rings.

Conveyor Route

The belt conveyor, which is shown attached to the superstructure of the old bridge, parallels the new concrete structure and conveys concrete approximately 1,200 feet from the point of mix to the maximum discharge point. It has been handling 300 cu. yds. of concrete per day without taxing the belt in any way to its maximum capacity and without working the small crew of laborers any more than the normal 10 hours per day. The concrete as discharged by the belt, is free from segregation and has been constantly giving compressive strengths which are more than twice the requirements both as to strength and density.

Concrete Strength

The concrete almost universally throughout the job has shown a 28-day compressive strength of over 4,000 pounds and our requirements are only 2,500. Any degree of strength can be obtained by this method of placing con-

At the left is seen the track over which the steel truss centering units are moved from span to span. The enclosed belt conveyor for transporting the concrete is shown at the right

Places Concrete Perrysburg Bridge

The housed-in belt conveyor which took the concrete for the seven 105-ft. spans from the mixing plant to the forms was suspended from the old bridge in the background. One of the arches is shown completed

300 cu. yds. of concrete placed per 10-hour day.
Concrete conveyed 1,200 ft. from point of mix.
Belt conveyor attached to old bridge which paralleled new location.

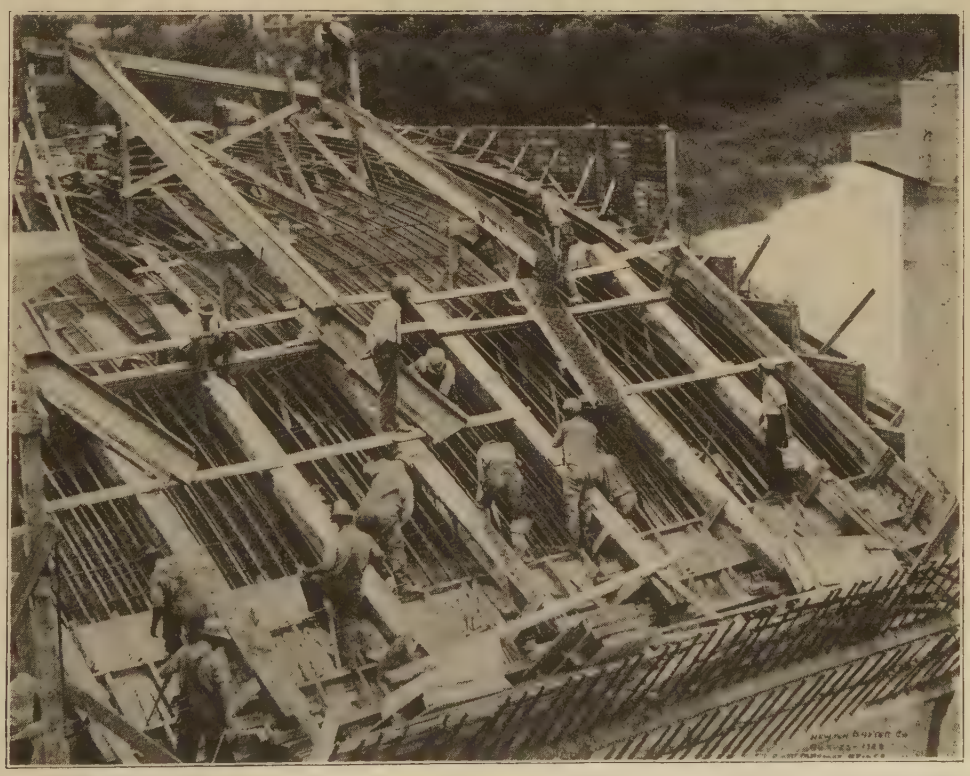
crete and the speed of placing is governed by our ability to properly rod it in the forms, rather than the transporting of it from one side of the river to the other.

Use of Trusses

The concrete arch rings are supported by self-centering steel trusses of 105 foot span, which are lagged together in pairs and then moved as units from ring to ring. The moving is accomplished by large steel dollies which run on standard gauge railroad tracks and the complete move from one point to another is accomplished in six days.

There are seven 105-ft. spans and the first arch ring was poured July 26th. The third arch ring was completed August 25th, which means that three have been completed in 30 days. We will easily complete the bridge, open for traffic, by January 1, 1929, which is six months prior to the scheduled date of completion.

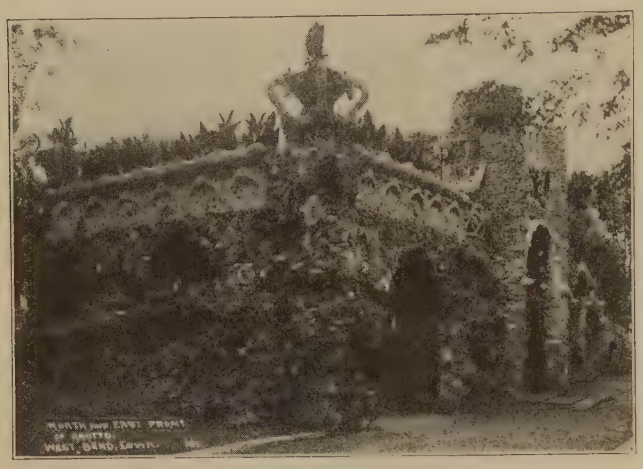
A close-up of the take-off knife that strips the concrete from the belt. S. A. Baxter is shown inspecting the work



A constant stream of concrete flowed from the belt conveyor to the forms. 300 cubic yards of concrete were placed per 10-hour day. The farthest discharge point on the belt was 1,200 feet from the mixing plant

Odd Stones Set in Concrete Form Shrine

Concrete forms the base for odd and precious stones of all sorts that are being used in the erection of the Grotto of the Redemption, a religious shrine at West Bend, Iowa.



Stone placed in concrete are used to depict the bibical story. Ores, fossils and petrifications, corals and shells of the entire western hemisphere are to be gathered and

placed in the structure by the builder, a priest. Italian statuary will comprise the necessary figures, of which the stone will form the scenes and background.

Influence of Durability Test on the Strength of Concrete Aggregate

In the course of the investigation of the durability of concrete aggregates made by the Bureau of Standards, it was noted that the limestone specimens were subject to more or less disintegration in the boiling and drying test cylinders. To study this phenomenon further, a group of eight random samples of limestone block were selected, 2-in. diameter cylindrical test pieces approximately 2 in. high, or 2-in. cubes, being cut from each.

Before starting these tests each specimen was carefully examined for any cracks or other defects. The tests were carried out for 100 cycles, each cycle consisting of boiling in water for six hours and drying at 110 deg. C. for 17 hours. As the test progressed careful visual examinations were made from time to time without any signs of disintegration being noticed.

Comparative compressive strengths were determined upon untreated samples cut from the same blocks of stone. The results of these tests are given in the following table. In every case but one the boiling and drying cycles caused a reduction of strength.

There is an average reduction of 38 per cent in strength as a result of the 100 cycles of boiling and drying treatment. In Sample No. 6 the average strength of the treated specimens is lower than the strength of the untreated specimens, the one case where the strength of the treated sample was higher than the untreated being evidently due to the selection of a portion of the stone having a relatively high strength.

	Strength	
Stone No.	Untreated samples Lbs./in.^{2}	100 cycles of boiling and drying Lbs./in.^{2}
1	8,500	5,450
2	9,700	3,160
3	5,600	4,970
4	6,750	4,240
5	7,850	3,070
6	3,500	4,240
6	3,500	1,890
7	7,550	5,870

New Books

"Exemples de Calculs de Constructions en Beton Arme," by L. Cosyn. Published by the Librairie Polytechnique Ch. Beranger, Paris.

This is a rather interesting book on design calculations, containing as it does some material not found in the ordinary texts.

Quite a little space is given to the discussion of costs and calculations on form work. There is also a very complete chapter on the design of concrete silos which is a rather welcome addition to what material is already available on that subject.

In this chapter silos are divided into four types—square, hexagonal, octagonal, and circular. The design of each type is discussed in considerable detail, and the formulas necessary for the calculation of each type set forth.

All of the standard problems of reinforced concrete are given proper consideration, some of them being discussed from much the same standpoint as in other texts, and others being treated in an original manner.

Coming Conventions

American Concrete Institute—February 12th to 14th, 1929. Twenty-fifth annual convention, at the Book-Cadillac Hotel, Detroit, Mich.

American Road Builders Association—January 14th to 19th, 1929. Convention and road show, at the Cleveland Public Auditorium, Cleveland, Ohio.

Concrete Reinforcing Steel Institute—October 1st to 3rd. Fall meeting, at Buckwood Inn, Shawnee-on-Delaware, Pa.

National Safety Council—October 1st to 5th Seventeenth annual safety congress, at the Pennsylvania Hotel, New York City.

Reinforced Concrete Design Simplified

Chart F—Stirrup Spacing

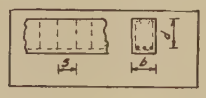
By PROF. JAS. R. GRIFFITH
Armour Institute of Technology; Assoc. M., A. S. C. E.

Joint Committee Specifications

$f'_c =$ 2,000 lbs. per sq. in.
$f_c =$ 800 lbs. per sq. in.
$f_s =$ 18,000 lbs. per sq. in.
$n = 15$

$$s = \frac{A_s\, 18{,}000}{(v - 40)\, b}$$

Maximum, $s = 0.45\, d$



THREE values are necessary before the stirrup spacing can be determined by Chart F for any section of a beam. First, the cross-sectional area of the stirrup is obtained by multiplying the area of the bar used by the number of sections which would be cut by a horizontal plane. The location of the most common stirrups have been shown on Chart F. Second, the breadth of the beam as determined from previous design. Third, the unit shear at the section in question as determined by Chart D-1.

Chart F Application

The maximum unit shear in a specific beam was determined in the July issue, from which

Breadth $(b) = 16$ in.
Effective depth $(d) = 25$ in.
Unit shear $(v) = 51.4$ lbs. per sq. in.

In the average design, satisfactory conditions will usually be found if the following stirrup sizes are assumed:

¼-in. round, for beams 10 to 25 in. deep;
⅜-in. round, for beams 25 to 40 in. deep;
½-in. round, for beams 40 to 60 in. deep.

These sizes do not constitute any fixed rule. In the wider beams, more stirrup area can be obtained by the use of the so-called "W" stirrup.

In the problem to be considered, if ¼-in. round "U" stirrups are assumed, isopleth (1), Chart F, is drawn from the stirrup size to the breadth of the beam. Isopleth (2) is then drawn from the unit shear through the intersection of isopleth (1) with the support. On the spacing scale will be noted a value for the stirrup spacing of $s = 9.8$ in. If substituted in the equation for stirrup spacing, we get

$$s = \frac{A_s\, 18{,}000}{(v - 40)\, b} = \frac{(2 \times .0491)\, 18{,}000}{(51.4 - 40)\, 16} = 9.7 \text{ in.}$$

This gives the necessary spacing at the support which is the point of maximum shear for this beam. In the September issue, we found that web reinforcing, for this same beam, was needed for a distance ($x = 2.8$ ft.). One foot from the support we should have, by similar triangles Fig. 1-F, a unit shear of

$$\frac{v'}{51.4} = \frac{(12.5 - 1)}{12.5}$$

$$v' = \frac{51.4 \times 11.5}{12.5} = 47.2 \text{ lbs. per sq. in.}$$

If the same sized stirrup is used, isopleth (1) will remain fixed. Isopleth (3) is now drawn for the new unit shear of ($v' = 47.2$), from which a stirrup spacing of ($s' =$

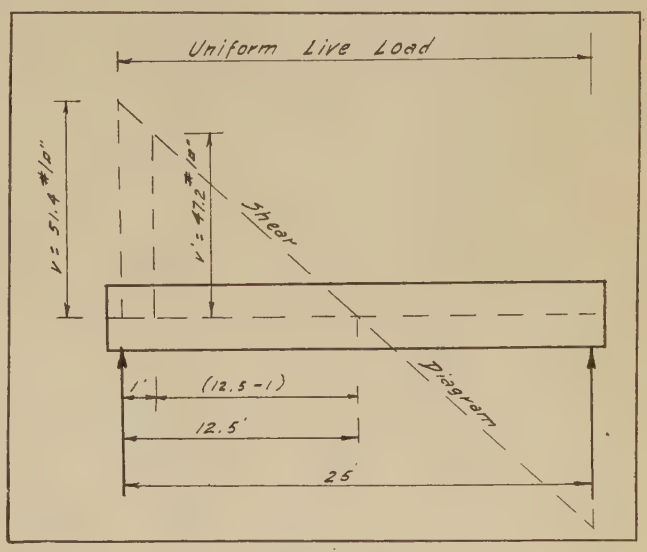


Figure 1-F

15.2 in.) is obtained. This value is, however, more than that permitted by Eq. 1-E.

Maximum, $s = 0.45\, d = 0.45 \times 25 = 11.25$ in.

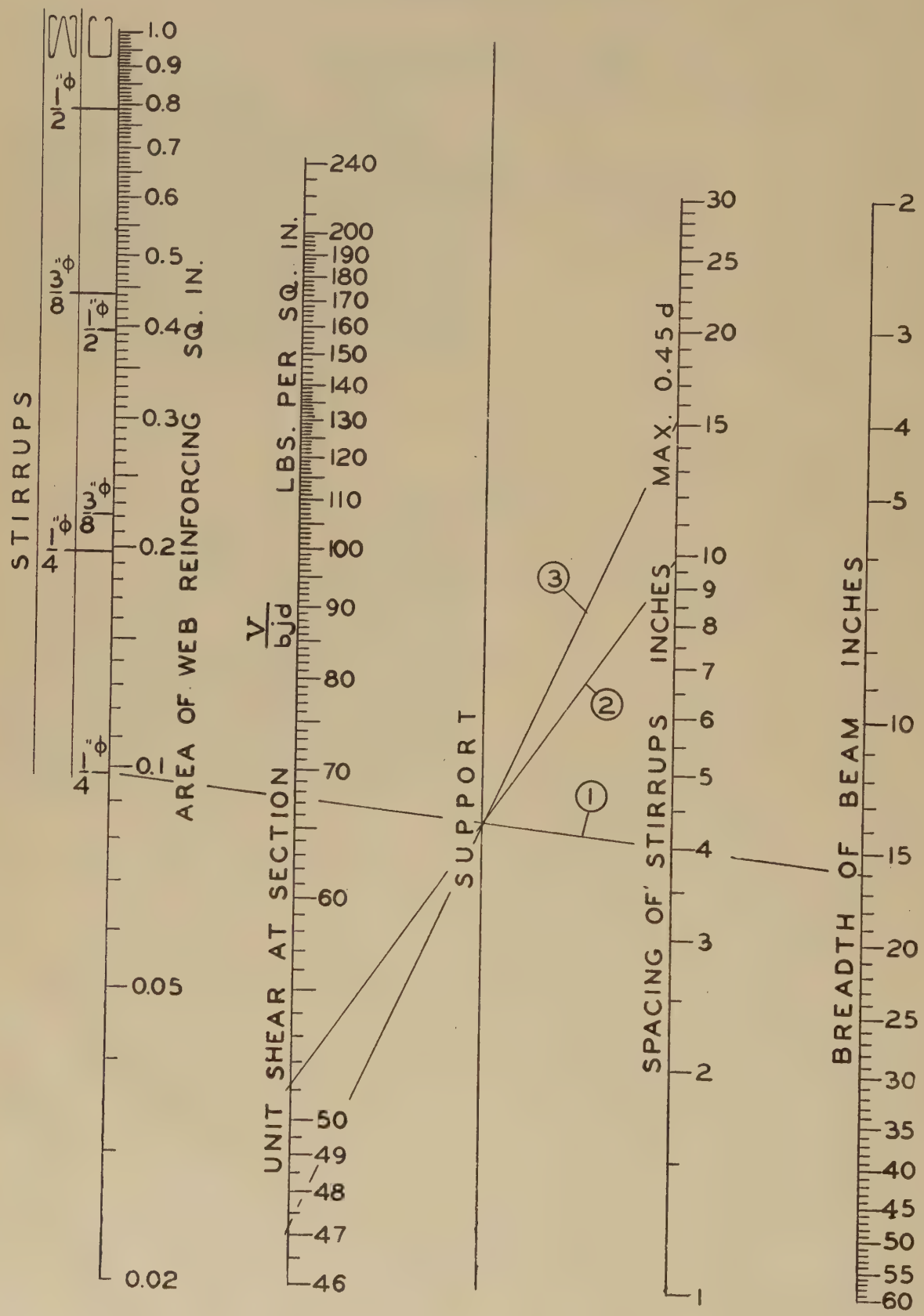
In the actual design, the stirrups would probably be spaced as shown in Fig. 2-F.

Practical Considerations

After the forms are completed, two bars of the longitudinal steel are usually placed. The stirrups are then spaced and tied to these two bars. The remainder of the longitudinal steel is then put in place. The foreman marks off, on the form side, the location of each stirrup. The stirrup, when finally in place, will probably vary ¼ to ½ in. from the intended location. For the convenience

CHART F

Stirrup Spacing



of the foreman, stirrup spacing should preferably be by full inches.

The shear, in a beam under uniform load, will vary uniformly. Theoretically, each pair of stirrups should then be at a different spacing in order to conform to the change in shear. In practice, however, the stirrups should be kept at a uniform spacing as much as possible. Thus in Fig. 2-F we have specified one space at 9 in., and two

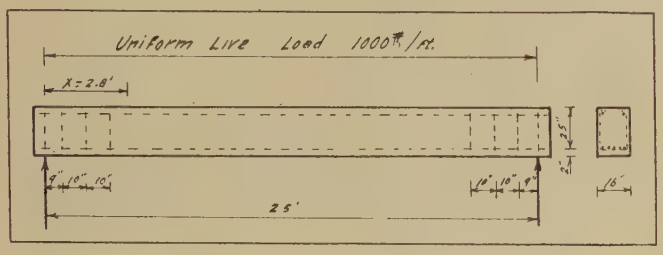


Figure 2-F

spaces at 10 in. When the necessary spacing becomes less than 2 in., a larger sized stirrup should be used. Don't crowd the stirrups too close together unless in a very shallow beam or in special construction where small spacing cannot be avoided.

A beam reinforced for only tension should have two ¼-in. round longitudinal bars specified in the top of the beam to which the stirrups can be tied. If the small rods are not specified, the steel workers will hold the top of the stirrups in place by longitudinal wires which are not of sufficient rigidity when pouring the concrete.

Joint Committee Specifications

The Joint Committee Specifications, in common with many, fail to specify the allowable stress in the stirrups. In constructing Chart F, the stirrups were figured as carrying the full allowable steel stress of ($f_s = 18{,}000$ lbs. per sq. in.). Many designers prefer to keep this stress at a lower value, but as many will argue that there is no justification for keeping the stirrup stress down.

The Joint Committee does not consider stirrups, which are not anchored at both ends, as effective web reinforcing. It is customary to anchor the ends by a hook having a radius of bend at least four times the diameter of the bar.

The Joint Committee Specifications allow a unit shear of 40 lbs. per sq. in. without web reinforcing. The stirrups are then figured as carrying the additional stress. Thus at any section, the unit shear to be carried by any stirrup is equal to $(v - 40)$. The total shear in each section can then be equated to the total stress in the stirrup:

$$(v - 40)\, s\, b = A_s f_s$$

or

$$s = \frac{A_s\, 18{,}000}{(v - 40)\, b} \qquad \text{Eq. 1-F}$$

A_s = Total area in stirrup cross-section
v = Unit shear at any section
b = Breadth of beam
s = Spacing of adjacent stirrups.

Chart F has been so plotted that the unit shear, as found by Chart D-1, is used without subtracting the 40 lbs. per sq. in. carried by the concrete.

Construction of Chart F

The expression to be plotted, Eq. 1-F, is a four-variable equation and, as in the past, will be split into two three-variable equations having a common variable (F).

$$s = \frac{A_s\, 18{,}000}{(v - 40)\, b} \qquad \text{Eq. 1-F}$$

$$s\,(v - 40) = \frac{A_s\, 18{,}000}{b}$$

$$F = s\,(v - 40) \qquad (1)$$

$$F = \frac{A_s\, 18{,}000}{b} = 18{,}000\, A_s \frac{1}{b} \qquad (2)$$

Expression (2) was first plotted. It resembles the general expression, Eq. 7, requiring logarithmic co-ordinates. The A-10 scale was used for the (L) and (R) scales making $r = 1$. Equating the general exponents of Eq. 7 to the actual exponents of expression (2), we have

$$\left.\begin{aligned} \frac{mn}{r} &= \frac{mn}{1} = 1 \\ m(1 - n) &= 1 \end{aligned}\right\}$$

which, when solved simultaneously for values (m) and (n), gives

$$\left.\begin{aligned} n &= \frac{1}{2} \\ m &= 2 \end{aligned}\right\}$$

Expression (1) also resembles Eq. 7 and has, for a value of $r = 1$, the same values of (m) and (n) as expression (2). If the A-10 scale is used for values of $(v - 40)$ and

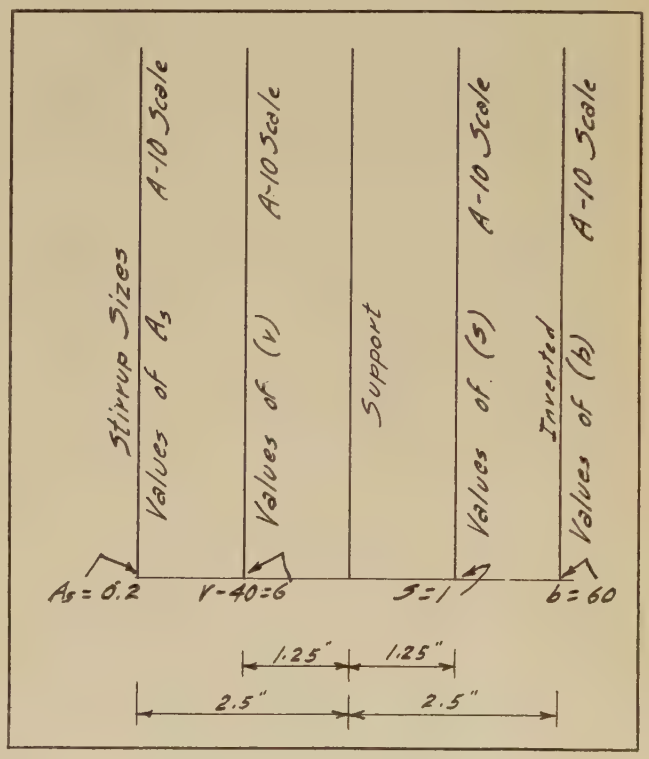


Figure 3-F

(s), the (F) scale for both expressions will have the same size co-ordinates and can be used as a support without co-ordinates.

Inverted Scale

Since $\left(\frac{1}{b}\right)$ is to be plotted, this scale, as explained be-

fore, will progress down the page, and is frequently called an inverted scale. While $(v-40)$ is to be plotted in expression (1), a table can be prepared similar to Table 1-E, and the values of (v) labeled at the corresponding locations for $(v-40)$.

A construction isopleth was drawn at the bottom of the sheet for values of $(A_s = 0.02)$, $(s = 1.0)$, and $(b = 60)$. Substituting these values in Eq. 1-F, we get

$$v - 40 = \frac{A_s\, 18{,}000}{s\, b} = \frac{0.02 \times 18{,}000}{1 \times 60} = 6$$

which gives a point from which the $(v-40)$ scale can be calibrated. This point represents a value of $v = 46$ and is so labeled.

Fig. 3-F gives complete details by which the original of Chart F was constructed.

A Logical Field for the Concrete Products Manufacturer

A Minnesota Concrete Products Manufacturer Finds It Profitable to Contract the Odd Concrete Jobs Often Done By the Farmer

By G. J. TRAGETHON

SHALL the farmer do his own concrete work? Or is this a field where the products manufacturers, especially those located in farming communities, can extend their activities profitably?

Farmers use a great deal of cement. Often they know very little about making concrete. When one of their "home-made" structures fails, they are apt to condemn all concrete structures as a result of their experience.

It has been suggested that this is a logical field for the concrete products manufacturer. Following is a letter from G. J. Tragethon, proprietor of the Boyd Cement Works at Boyd, Minn., in which he presents some reasons why the concrete products manufacturer should enter this field and tells of his experiences doing this sort of work.

Comments from other products manufacturers on this subject will be welcome.

"IN connection with my concrete products manufacturing I do a good deal of concrete work for the farmers of this community. It has been my experience that those farmers who have attempted to do their own work believe less in the durability and economy of concrete than do those farmers who hire experienced men to do their concrete work.

Danger of Poor Sand

"There are several reasons for this. The farmer is, and should be, principally a farmer. He cannot expect to learn much about concrete work nor can he expect to understand this work when it takes another man years of steady labor to learn how to do it right. There are several reasons why the farmer's own concrete work is apt to fail. The principal one—at least around here—is that the farmers use a poor grade of sand. Many farmers use sand from their own pits. This sand is naturally of poor grade containing clay and slate. Then, when the work crumbles, the farmer judges all concrete to be as his was. This is all wrong, for a good grade of sand will make concrete which will last forever.

Where Knowledge Is Necessary

"Other causes for failure are poor mixing, using the wrong mix, and not caring for the concrete while it is curing. The farmer does not realize how much these three things influence the production of good concrete, and how much the failure of concrete is increased when these facts are ignored. One has to study to learn to do things right and few farmers have either time or patience for this. The last cause—caring for concrete while curing—is most often ignored by the farmer.

"I always instruct my customer to keep the concrete as wet as possible for several days, especially where it is exposed to the sun, to prevent it from drying too rapidly and peeling. Many of them express astonishment at this, saying that they think that too much water will hurt it. This shows that the average farmer knows little about concrete. Of course, there are some who can do a little of this work but they are very few. Even these cannot expect to do as good a job as an experienced man can.

Concreting Is a Business

"And so I would like to say that no one, and especially the sand and cement companies, should advise the farmer to do his own work, for it is to their interest that the farmer receive the best from concrete construction, and he can only get this by employing experienced labor.

"I think that if we could induce the lumber yards to handle concrete products, we would be taking a big step in advancing concrete construction. At the present time they are all handling and pulling for clay products.

"I hope that the few ideas which I have given may in some way help other concrete producers and workers. Every little bit we do will help us onward toward the concrete age into which we are gradually entering."

"Products Association Accomplishments"

Some Comments by Products Manufacturers on an Editorial Published Under the Above Title in the September Issue

AN editorial, published in the September issue of "Concrete" under the title, "Products Association Accomplishments," pointed out that an industry growing as rapidly as is the concrete products industry presents many opportunities for co-operative work to the end that the industry may come nearer to realizing its fullest possibilities.

As mentioned in that editorial, it was not our purpose to recommend or to suggest any change in the concrete products association. The point was merely raised that there are great potentialities which could be brought nearer to realization if the efforts of all products manufacturers and of all local organizations were co-ordinated in some manner.

In the following pages are published some comments received from concrete products manufacturers in which they suggest possible methods for attaining these ends. Further discussion is invited.—The Editors.

A Suggestion From "SPEC" COLLINS

Following are some thoughts on this subject sent in by "Spec" Collins under date of September 14th.

"May I again 'speak my mind?' This time regarding the editorial in the September issue of CONCRETE, 'Products Association Accomplishments.' I'll admit that the present national association does not have the contacts with its members that most of us would like to see, but I believe it has great possibilities as a promotional organization. So far its greatest accomplishment has been the creation of the Certificate of Quality idea, which has done much to improve the quality of our product and has been an excellent asset to the industry. The annual conventions have done a great deal to instill a spirit of comradeship among manufacturers and I have never attended one without receiving help of some sort.

"In your editorial you solicit constructive suggestions. I hope you receive many of them, for if we can find out what the industry wants, as a whole, we can surely call on the industry for support. I have been rather interested in reading in the July issue of *Concrete for the Builder*, a British publication, of the trials and tribulations that have beset a group of manufacturers who last year organized a concrete products association in Great Britain. At their meeting last year it was agreed that the country be divided into eight areas and that the manufacturers of each area should elect a representative to the council. A ballot was then taken in each area and these representatives elected to make up the council. As I take it from this article, the area representatives will transact the bulk of the business of the association.

"In a country the size of Great Britain, with an area of but 88,000 square miles (an area slightly smaller than that of our own state of Montana) this plan should work out excellently. In fact our own association has a board of directors chosen in somewhat the same manner. It is unwieldy, however, and not a working board because it has little available time for work and because it has never been called into action except at the annual conventions. Now let us apply the theory of the English association to our own organization, that of making the council do the work, and see how it will work out.

"My proposal is this: that the working body of the national concrete products association be made up of a council of board of directors *elected by local concrete products associations and by state concrete products associations.* One representative would be allowed from each of these associations. Let the Concrete Products Association pattern its organization and operation after the original purpose of the Associated Advertising Clubs. The original intent of the Associated Ad Clubs, to quote from Gilbert T. Hodges, president of the Advertising Club of New York, 'was to be a sort of parent body for the local clubs. It was to encourage and aid the establishment of clubs in new localities, to co-operate with the existing clubs, helping to frame programs and assisting officers in club management, all for the betterment of advertising in general. It was for the local clubs to make the contact with the public, except for an annual convention of the entire body of clubs.'

"I would eliminate a convention of the Concrete Products Association for the next two or three years. In its place I would substitute a meeting of the council or board of directors. I would have every man on this board sent there by the concrete products association he represented. Instead of spending the bulk of their time at open convention sessions this group of men could gather around a table and thresh out the problems of the industry. They could adopt a national program that could be carried back to the state or local associations to be adopted and worked on by these associations during the ensuing year.

"At the past conventions the meetings of directors have been all too short. Important business has been hurried through or has been slurred over in an attempt to carry it out in the short time allotted for its performance. No definite program has been adopted or followed and little of value has been passed on for the local and state organizations.

"I believe that the first meeting should be held in Detroit at the time of the American Concrete Institute. I would have every director sent there by his own products

association whether it be sectional, local or state. He should have instructions to bring back a definite report of the meeting and its recommendations. It is my belief that this small group of men, meeting together for, say, two days around the directors' table and with the good of the industry at heart, could accomplish much. Sub-committees within the board might ease its burden.

"If every one of these men came back to his own organization with a definite program and with specific information on how the various 'planks' of that platform were being carried out in the various parts of the country it would do much to help the various associations who are now struggling along with no definite leadership or help from the outside. And I do not believe these meetings of the board should be limited to one a year— two meetings at least and perhaps three or four would be necessary. However, I think that three or four meetings of this sort will accomplish more than a dozen conventions. The only real cost to the state and local organizations, for a time at least, would be that of the expenses of their representatives and the transcribing of the minutes of the meeting. I believe that with the perfection of an organization of this sort we can soon have practically every state, sectional and local products association in the country working along the same program and accomplishing a general good for the industry."

Discussion by AUSTIN CRABBS

Perhaps one of the reasons for the lack of interest in the work of the national Concrete Products Association during the past year or so can be found in unfavorable prices or in actual price wars that have been raging among products manufacturers in many localities. These unfortunate local conditions have demanded the manufacturer's attention and, as a result, he hasn't had time to give to the national problems facing the industry.

While these price wars are difficult problems for all concrete products manufacturers, I cannot help but feel that they are, in a measure at least, responsible for a favorable trend, as evidenced by the fact that many of the less efficient manufacturers are dropping out of the game.

This is a condition that will ultimately work for the good of the industry. The business is gradually getting into the hands of the more efficient men, in fact it probably is a case of the survival of the fittest and the industry will never reach its greatest possibilities until through even more efficient production, we are able to make a reasonable profit at prices that compare even more favorably with those of competitive materials.

Another possible reason for lack of interest in a national concrete products association is the fact that the Portland Cement Association, the American Concrete Institute and even individual cement manufacturing companies are doing so much for the concrete products industry. From one point of view, it would be better if the products manufacturers would be forced to do most of this work themselves. The industry has had too many things done for it. It has been helped and encouraged and coddled. It has never been forced to stand or fall by its own efforts.

However, with the work of research, operating problems, specifications, promotion, etc., largely being taken care of by these other organizations, the only reason for the existence of a national association would be to do necessary work that is not already being done for us. One of the most important things the national association can do along this line is to educate its members on the economics of the industry. Here is a field where an an association of this sort could justify its existence and render valuable aid to its members.

In order to do this work properly, the association should appoint a full-time, paid secretary who would devote all his time and energy to the work of the association. He should be provided with enough funds so that he could make a personal investigation of conditions in the various localities and consult with the members on their local problems.

For example, in our city there are five or six plants, all working independently. Perhaps our locality would benefit through the consolidation of some or all of these plants. If this should be the case, it would be a difficult matter for us to get together on our own initiative and effect such a consolidation. But a national secretary could step in as an outsider with no ax to grind, and he could probably bring about the merger. An outside viewpoint, backed by a study of conditions in many locations, is often just the thing needed to rectify an unfavorable local condition.

It is my opinion that a national concrete products association should *not* be composed of individual manufacturers. It should be a body of delegates selected by local or state groups to represent them at the national meetings. The duties of these delegates would be to select a secretary and to consult with him on the affairs of the association. The secretary would make his individual studies of conditions in the various localities, report to the delegates at the national meeting and make recommendations for a program based on the industry's needs.

In addition, the national association should have a small executive committee (not more than five men), who will meet with the secretary at least four times a year to consider problems that should not be deferred till the annual meeting.

A small number of delegates should be sufficient to meet the needs of the association at the present time. The number could be increased from time to time as occasion demanded and as the scope of the work increased. Gradually the association could undertake additional work such as advertising, technical research, and so forth, and be in a position when the right time comes, to co-operate with those who at present are so ably and generously working in our interests or perhaps some day, even take over this work, which by rights, should be ours to do.

Construction Costs Reach Peak for the Year

Construction costs are higher than at any time since last December, according to statistics just compiled by the Associated General Contractors of America. A substantial increase last month brought about this condition and served to place the present cost average on a plane exactly twice as high as the one it occupied in 1913.

The recently noted rise is attributed to an increase in the average of prices paid by contractors for the basic construction materials. This average, it is stated, was particularly influenced by prices which concrete aggregates and lumber commanded.

The average of wages paid in the construction industry remained unchanged during August, holding the position it assumed in June, when it registered a slight decline. The wage average has shown marked stability, having changed its plane only three times since October, 1926. These changes, consisting of one rise and two declines, have been small. The average of wages, in fact, has held virtually a single level for two years.

The average of the combined costs of construction materials and wages during August reached a position slightly lower than that which it held one year ago, although materially above the plane occupied during August, 1926.

Foreign Cement Competition

Some Reasons for the Establishment of a Tariff on Imported Foreign Cement—The Effect of Cement Imports on American Prosperity—Comparison of American and Belgian Manufacturing and Shipping Conditions

By GERALD EGAN
Cement Information Bureau

IT is not apparent to the man in the street that when he buys a foreign competitive article he is striking at the prosperity and buying power of his country by depriving his own people of their natural markets, by curtailing consumption and production, lowering wage scales, and endangering employment. These realities become remote when the opportunity for an immediate saving of a few dollars presents itself.

For this reason an industry faced by an active and damaging competition must look elsewhere than to abstract argument in its struggle to protect itself, its wage-earners and its stockholders.

A critical situation confronts the American portland cement industry which stands today without a shred of tariff protection.

During the past few years it has reduced its production costs and operating expenses to a minimum. It has earned the official commendation of the United States government for the efficiency of its methods. It has employed scores of scientists and expended vast sums in research and experiments to discover new uses of its product. Yet the entire economic stability of this vast industry—with its $600,000,000 investment and its 155 mills in 32 states is seriously threatened by the increasing importation of cheaply produced foreign cement.

What is a distinct threat to the entire cement industry throughout the country has become a disastrous reality to many seaboard mills. The eastern coast is under mounting invasion from Europe with the result that the most fruitful markets of the eastern manufacturers—the cities of Boston, New York, Philadelphia and several South Atlantic and Gulf ports—are being exploited by the foreign product.

American Plants Shut Down

Within the past month it has been found necessary to shut down a new $4,000,000 cement mill at Thomaston, Maine, and to add scores of persons to the rolls of the unemployed. This is the only cement plant in New England. It is operated by the Lawrence Portland Cement Company.

In announcing a 50 per cent curtailment of production, Frank H. Smith, president of the Lawrence company, said:

"This reduction has been caused by foreign competition. We are well pleased at the treatment we have received from the Maine officials, particularly in the highway department, but only 27 per cent of the cement used in the state during our first five months of operation was from New England's own cement mill. As a result we have about 200,000 barrels of cement on hand and the clinker storage is filled nearly to capacity. Other companies in the East are experiencing similar trouble and the production of our Pennsylvania plant has been curtailed 25 per cent. We cannot compete with the cement manufactured on a wage scale of 10½ cents an hour and until the matter is adjusted by tariff, the cement industry in this country is going to be greatly handicapped."

A few days later the Lone Star Cement Company of Pennsylvania announced a 65 per cent reduction in the output of a 1,800,000 barrel plant at Nazareth, Pa. In explaining this shutdown, D. S. MacBride, vice-president of the company, said:

"This partial shutdown will, of necessity, remove quite a number of men from our payroll, a condition which the management sincerely regrets. There is, however, no alternative under present conditions, which are largely due to the increasing importations of foreign cement which are coming into the northeast and central seaboard territories, particularly Philadelphia and Boston.

"The wage scale paid to European cement workers is approximately one-fifth of the scale at our Nazareth plant. Belgium has been the principal exporter to the United States, and the cement from that country, as well as from other foreign countries, does not carry any import duty, with the result that well-paid American workmen are placed in direct competition with poorly paid Belgian operatives.

"We shall continue our efforts to maintain our rightful markets but the permanent solution of the problem rests with the granting of an adequate tariff.

"This basic American industry is entitled to the relief of an import duty on cement that will equalize the overwhelming difference in wages and put an end to the unfair competition which is undermining American standards of living."

In announcing the suspension of the quarterly dividend of the Pennsylvania-Dixie Cement Corporation, John A. Miller, chairman, also held foreign cement largely responsible.

These instances of the demoralizing effect of duty-free cement imports could be multiplied almost indefinitely. G. S. Brown, president of the Portland Cement Association, in summing up the present condition, says, "Today in order to meet the competition of foreigners in our seaboard cities many domestic manufacturers are obliged to sell their product at an actual loss in those markets."

Affects Inland Market Also

Virtually every mill which depends in any way on eastern seaboard territory for its market has been more or less crippled. In order to maintain even a slender hold upon these markets and to keep their brands before the public, cement manufacturers have been forced to sell at a substantial sacrifice but as this practice cannot continue indefinitely the future of the industry is seriously menaced unless there is some immediate guarantee of relief.

The eastern seaboard is not the only sufferer. The capture of coast markets by foreign cement has forced the manufacturer to dispose of his product in interior mar-

kets and thus to dislocate those markets over a wide area. To make matters worse for the manufacturers in the interior, it is only necessary to point out that European manufacturers are able to ship their product to lake or gulf ports and to barge it along inland waterways in order to effect direct competition with interior markets.

Cement manufacturers have done everything they could to improve the efficiency of their operations and to sell cement as cheaply as practicable. But obviously this industry, without a tariff, cannot be expected to exist under the same conditions which other American industries are able to meet only because of tariff protection. This protection is denied the cement industry under the present tariff law.

In 1928 a total of more than 2,225,000 barrels of cement will be imported into the United States. This figure is based on imports for the first six months of the year. It is estimated that Belgium will supply 80 per cent of these imports.

Belgium, therefore, is the chief competitor of the American industry and a comparison of costs between the two countries should determine the validity of proposing a tariff duty.

In drawing such a comparison, it must be remembered that the Belgian standard of living is by far the lowest of the principal countries of Europe.

Wage Comparison

The Belgian cement worker receives a wage of twelve and one-half cents an hour or about a dollar a day. This is less than one-fourth of what the American cement worker receives. The small wage paid the Belgian cement worker is not exceptional in that country since coal miners, the highest paid labor, receive only one dollar and thirty-five cents a day. Masons and bricklayers get ten cents an hour; carpenters thirteen cents an hour; and common laborers, eight cents an hour. Since all labor in Belgium is restricted to an eight-hour day, Belgian wages average about six dollars a week.

The output of the Belgian cement industry is today 90 per cent greater in volume than before the war, yet the daily wages of the workers are 10 per cent less.

The tremendous disparity in wages might be justified in some measure if the American workman was able to produce cement more quickly, more skillfully or more economically than the European but there is virtually no difference in production methods. The competition, in the main, is that of Belgian labor against American labor.

The cement industry had a protective tariff for a long period of years which built up a high rate of wages and created a high standard of values growing out of the wages of the labor that produces its building, its machinery and other capital investments.

A new increase in wage scales followed restricted immigration which was supported by labor leaders. The sanest of these leaders today agree that if this restrictive legislation is beneficial when applied to men, it should apply also to their handiwork and that industries should not be crippled and unemployment deliberately invited by permitting the importation of vast quantities of commodities produced abroad by these potential immigrants under conditions with which American labor cannot compete.

The greater investment required for the American cement manufacturer and the higher rate of wages he pays grow out, therefore, of a national policy of which he is in this case the victim. The American manufacturer can in justice be asked to produce cement for as few man hours and as few pounds of coal as his foreign competitor, but he should not be made the special victim of the distinctly different economic policies of the two continents.

It may be thought that the cost of ocean freights is a handicap to the Belgian manufacturer selling to the American market. The marked increase in importations in recent years shows that just the reverse is true.

It is cheaper for the foreign manufacturer to ship today from Antwerp to Philadelphia than for the American manufacturer to ship from the nearest American mill to that port. The charge from Antwerp to Philadelphia is thirty-eight cents per barrel as against forty-six cents from Lehigh Valley to Philadelphia, a distance of 71 miles.

From Tampa, Florida, where a new mill recently went into operation, the railroad rate of shipment to Miami is about fifty-six cents per barrel. This compares with a nominal charge for ocean shipment from Antwerp to Miami of about thirty-five cents and foreign cement has been brought into Tampa in Belgian naval training ships at the ruinous ocean rate of fifteen cents a barrel. This Tampa mill is now closed on account of foreign competition.

In six years, 1922 to 1927 inclusive, more than 11,000,000 barrels of foreign cement were brought into and sold in this country, free of tariff duty. As a result, American cement workers made 11,000,000 barrels less of cement and lost $5,250,000 in wages. This shrinkage in the cement workers payroll represents, roughly, the loss of 800,000 days' employment and more than $5,000,000. But that is only the start of the leakage. The cement industry buys from many other industries. Considering only a few of these—coal, gypsum, textiles, machinery and railroads—the eleven million barrels of imported cement displaced labor to the extent of nearly 2,000,000 working days and represented lost wages totaling more than eleven and a quarter million dollars.

This labor loss represents only a small part of the loss which the American cement manufacturer has been forced to withstand. For in addition to keeping his plants going, increasing proportionally his capital and overhead charges, he has had to fight for his home markets with prices in many instances, below the cost of production.

Having in mind the help that America has given foreign producers in the construction of their plants by means of loans and every other facility for competing with us in the rest of the world, the cement industry asks if there is any reason why we should give them our home market also.

It propounds this question: Shall we put our own citizens out of employment in order that Europe may pay its bills at the expense of our own wage earners?

The American cement industry feels that it has an unassailable case against the present tariff law, and American cement manufacturers, supported by the thousands of wage earners they employ, are determined to press this case to the utmost in the court of public opinion and before national legislators.

Road Commission of World to Meet in U. S. in 1930

American methods of road improvement and road use will be studied by leading highway officials from all parts of the world when they meet in the United States in 1930. This is vouched for by Thos. H. MacDonald, chief of the United States Bureau of Public Roads and chairman of the Highway Education Board, who attended the recent sessions of the International Road Commission at Paris.

Mr. MacDonald attended as head of the official delegation representing the American government at the road meeting. He later made an investigation into phases of highway development in many of the countries of Western Europe and in the British Isles.

How to Build a Concrete Automobile Oiling and Inspection Pit

The Construction of Concrete Automobile Oiling Pits Offers an Opportunity for Contractors—Their Advantages—How They Are Built—Working Drawings—Material Required

THE work of changing the oil in the crankcase, transmission and differential of automobiles is very greatly facilitated by some sort of construction which will either elevate the automobile above the ground, or enable the operator to get beneath it without maintaining a prone position. Inspection and repair of many parts of an automobile are also more quickly and easily done by elevating the automobile or placing it over a pit. Many garages and oil filling stations have already installed simple structures for these purposes.

The wooden type of elevated structure is at best a temporary affair and, if inside a garage and forming a pit, may constitute a fire menace. The concrete pit, however, is not subject to maintenance charges and can contribute nothing to the fire hazard.

Details of a Concrete Pit

The accompanying details of a double concrete lubricating pit for automobiles have been found practicable and satisfactory.

A combination of the platform type and the sunken type illustrated on the opposite page appears to be the most economical and practicable type. The detailed drawing shows such a combination. It is elevated 2 ft. above the ground surface and gives a headroom of 4 ft. 9 in. below the wheelway. Easy access to this pit is afforded by steps between the wheelway guards.

A reservoir is provided in this design for the storage of oil drained from cars. This storage pit can be made in sections to keep the different weights of oil separated, if desired. Storage for used oil is thus provided so that the only expense is reclaiming in case it is deemed worth while to preserve and reprocess the oil. In the double roadway type the reservoir is between the two pits, but in the single type the reservoir is under the floor of the pit. A manhole is provided with a cover so that the oil can be pumped from the reservoir. Drains are also provided to prevent water from accumulating in the bottom of the pit.

Bill of Material for Two-Pit Layout

Concrete, 1:2:4 mix—21 cu. yds.
Cement—32 bbls.
Sand—10 cu. yds.
Stone—20 cu. yds.

Reinforcement Steel

626 lbs. of ½-in. round bars.
38 lbs. of ⅜-in. round bars.

664 lbs.—Total.

Fittings, Etc.

4 18-in. galvanized iron funnels with screens.
10 ft. of ½-in. galvanized iron pipe.
8 ft. of 1½-in. galvanized iron pipe.
8 ½-in. galvanized iron elbows.
8 1½-in. galvanized iron elbows.
40 ft. of ¾-in. standard conduit pipe.
10 elbows for standard conduit pipe.
2 tees for standard conduit pipe.
4 outlet boxes.
24 ft. of 6-in. concrete tile sewer pipe.
2 standard floor drains.
1 grease trap.

Bill of Material for Single Pit Layout

Concrete, 1:2:4 mix—12 cu. yds.
Cement—18 bbls.
Sand—6 cu. yds.
Stone—12 cu. yds.

Reinforcement Steel

316 lbs. of ½-in. round bars.
32 lbs. of ⅜-in. round bars.

348 lbs.—Total.

Fittings, Etc.

2 18-in. galvanized iron funnels with screens.
5 ft. of ½-in. galvanized iron pipe.
4 ft. of 1½-in. galvanized iron pipe.
4 ½-in. galvanized iron elbows.
4 1½-in. galvanized iron elbows.
20 ft. of ¾-in. standard conduit pipe.
5 ¾-in. elbows for standard conduit pipe.
1 ¾-in. tee for conduit pipes.
2 outlet boxes.
10 ft. of 6-in. concrete tile sewer pipe.
1 standard floor drain.
1 grease trap.

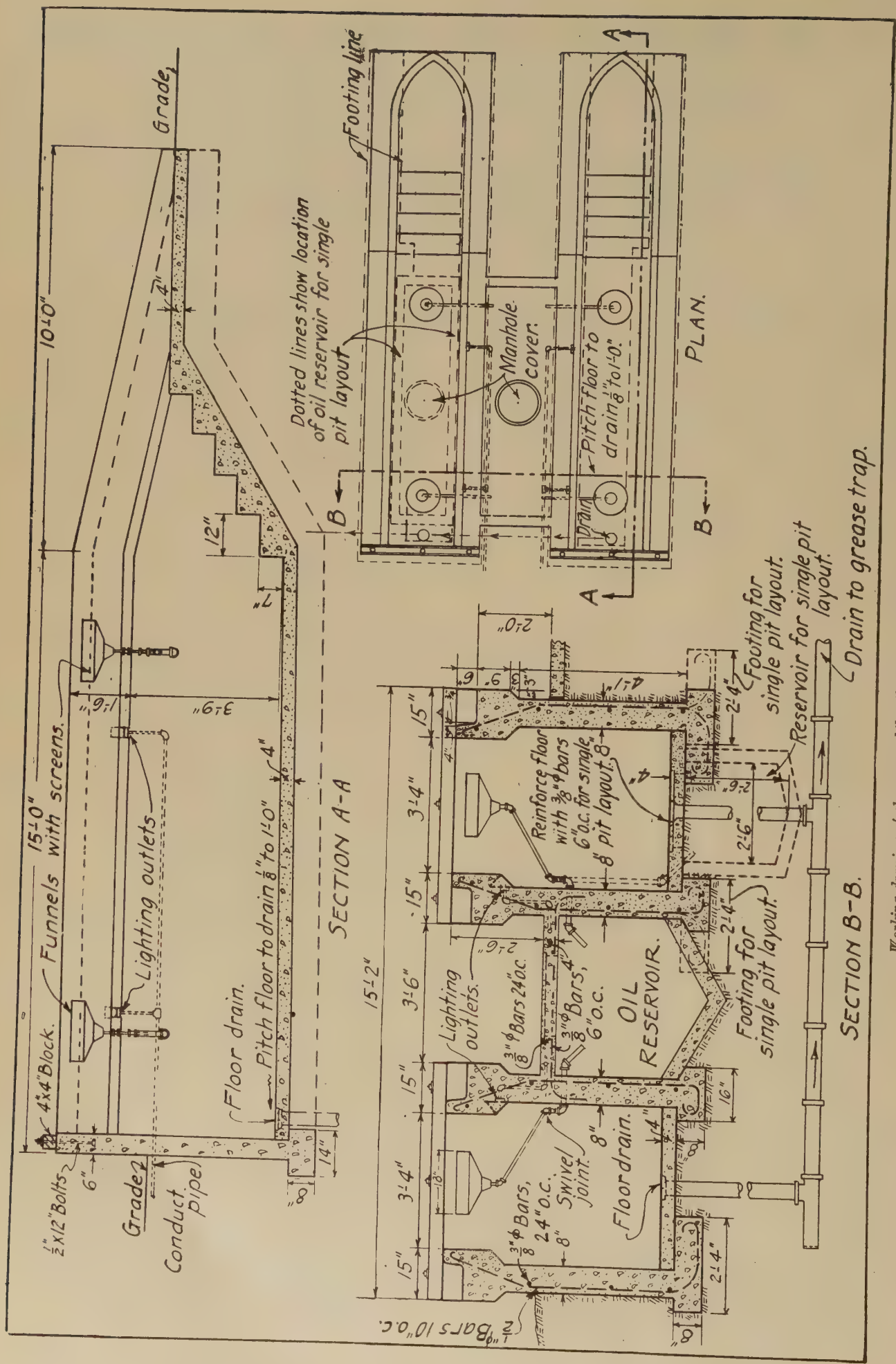
With these bills of material at hand, it is easy to compute the cost of constructing either the two-car or one-car pit for labor and material conditions in any given locality.

Colored Concrete in Lincoln Highway Markers

The Detroit Cast Stone Company, Detroit, Mich., has just completed filling a contract calling for red, white, and blue concrete on the face of concrete highway markers. The posts were especially designed for the Lincoln highway.

On the side facing the motorist appears an arrow, cast of blue concrete and indicating direction of travel. The red, white and blue concrete appears on the face, topped by a bronze medallion of Lincoln, 4 in. in diameter.

Announcement that marker designs were desired was made early in the spring and hundreds of plans were submitted. The Lincoln highway directors selected that offered by Jens Jensen, architect of Ravinia, Ill. The technical department of the Portland Cement Association assisted in the construction of the posts.



Working drawing of the automobile oiling pit described on the opposite page

Crazing of Concrete Floors

A Discussion of Some of the Causes of Crazing — Suggested Remedies — Finishing Methods for Concrete Floors—Curing—Preparation of the Floor Slab Base—Effect of Crazing on Strength

By ROBERT KAUFMAN
Technical Research Committee, The Master Builders Co.

THE subject of crazing of concrete is not new nor did crazing begin with the advent of portland cement. The most striking, the most common and probably the oldest example of crazing is the dried up mud puddle.

Crazing has been a problem for years, not alone in the cement industry, but in the tile and pottery industries. And whereas the causes of crazing in pottery and tile have been ascertained and in a large part corrected, very few know the causes of crazing in concrete and very little is known of measures to prevent it.

There are a number of factors responsible directly or indirectly for crazing. They are:

1. Sand or aggregate.
2. Water-cement ratio.
3. Finishing methods.
4. Curing methods.
5. Expansion and contraction due to atmospheric moisture.
6. Expansion and contraction due to changes in temperature.
7. Improper preparation of the slab base.

Although other contributing causes may be given, these constitute the principal ones, and as all are subject to more perfect control, let us consider them in the order given.

Sand

Very few realize fully the important part that the quality of the sand plays in the cement mixture. Of the three elements which enter into concrete, cement, sand and water, the sand from the standpoint of the user is probably the most important as its quality is to a greater degree within control. Inasmuch as the established brands of cement must pass the standard specification, they are all substantially the same, particularly so as manufacturers are constantly on the alert to maintain and increase uniformity of their products.

The sand which may be used in concrete work may be either silicious or calcareous. The grains should be preferably hard, sharp and angular. The sand should contain no loam, silt, clay or other vegetable or organic matter. Organic matter will greatly decrease the strength of cement mixtures or even destroy them entirely.

There is a simple test for organic matter in sand that can be performed by anyone: Fill a bottle about two-thirds full of sand to be tested and then fill to about 1 in. above the sand with a solution of caustic soda and shake well. Allow to settle for about 12 hours. The color of the solution above the sand will determine the amount of organic matter present. If none is present, the solution above the sand will be colorless. If there is a large amount present, the solution will be dark brown to black. If there is more than a slight coloration the sand is unfit to use without further analysis.

The next point of importance is the fineness of the sand. When two or more parts of sand are used to one part of cement, the greatest tensile strength is obtained with the coarser sand. The greatest resistance to abrasion is also obtained with the coarser sand, providing the sand is harder than the cement. The coarser sand also tends to reduce hair crazing due to the increase in strength and also to the fact that when floors are troweled, the sand which passes the 40- or the 60-mesh screen is floated to the surface. This fine sand has much more surface to be covered with cement and consequently the concrete containing it is weaker than the rest of the body.

If a coarse sand such as passes a 20-mesh sieve and is all retained on a 60-mesh sieve is employed, and an amount of cement is used sufficient to exactly fill the voids in the sand, it is my experience that a resultant concrete will be produced which will be as free from crazing as is theoretically possible, providing the other necessary requisites described here are met.

Following are the results of some tests made by the writer to determine the effect on tensile strengths of various gradings of sand. As tensile strength varies as a rule inversely with the extent of the crazing, these results indicate that through the use of coarser sand, crazing can be reduced.

Effect of Sand on Strength

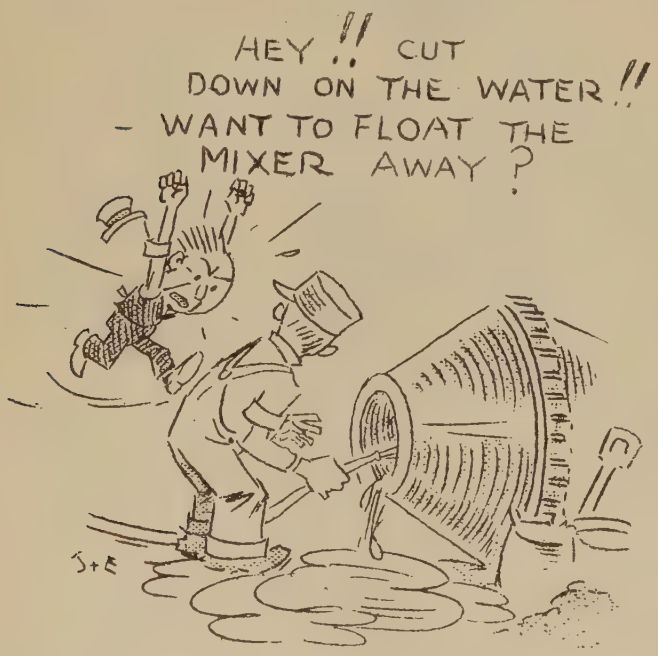
Pelee Island sand was used, screened to three grades of fineness, as follows:

Grade A—all passing through 20-mesh and retained on 30-mesh.
Grade B—all passing through 30-mesh and retained on 40-mesh.
Grade C—all passing through 40-mesh.

Tensile strength briquettes were made, proportions 1 cement, 2 sand, stored in moist air for 24 hours and thereafter in water until broken. Three different brands of cement were employed and their average strengths are reported.

Fineness of Sand			Average of Three Brands of Cement	
Parts "A"	Parts "B"	Parts "C"	28 Days	1 Year
100	0	0	378	582
0	100	0	298	479
0	0	100	225	394
50	50	0	326	529
33 1/3	33 1/3	33 1/3	286	475

From the above results it will be very readily seen that great increase in strength results from the use of coarser grades of sand. Therefore, we believe that the use of fine sand mortars for floor toppings should be discouraged. Effort should be made to eliminate clauses in specifications recommending the sieving out of coarser particles (between ⅛- and ¼-in.) because it is precisely these coarse particles that are effective in reducing shrinkage and crazing. Instead of sieving out the coarse particles of sand, it is desirable to increase not only the amount present, but also to make these coarse particles just as large as is compatible with the thickness of the topping and ease of troweling. This is best done by the addition of roofing gravel or crushed stone ranging from ¼- to ½-in. for floor toppings averaging 1 in. in thickness. It is possible to add from 1½ to 2 volumes of this coarse aggregate to a 1:1 mortar and still obtain a mixture that



will work smoothly underneath the trowel. Experience shows that a mixture proportioned 1:1:2 has from one-third to one-half of the shrinkage shown by 1:1 mortar made from a fine grain sand.

Water-Cement Ratio

Water used in the mixture is probably one of the most abused variables in cement work. In mixing concrete, there is a tendency to produce a wet mortar that will flow readily from a mixer which has more or less concrete hardened on it—and a mortar that can be spread over the floor with a minimum of labor. This wet mix is then followed by the float and very often immediately troweled. This method brings an excess of fine cement and sand and excess water to the surface, thereby resulting in a very soft finish because before this large excess of water can possibly evaporate the particles of cement start to crystallize and being separated by water have relatively little cementing value.

Then as the floor dries out the surface, being the wettest and at the same time the weakest part of the mass, shrinks and forms the minute hair checking which we call crazing.

The amount of water used in mixing concrete should be gauged very carefully inasmuch as so little as 4 per cent of additional water will decrease the tensile strength 50 per cent at short time periods. The water-cement ratio should never exceed 4½ gallons to the sack of cement.

Finishing

The ordinary workman in finishing concrete wants to do so in the easiest possible manner, and the contractor sometimes requires his workmen to cover a certain area in a given time. Hence the cement finisher is generally asking for more water in the mix to lighten his labor and to enable him to cover the required area in the allotted time. The inevitable result of this added water is a cracked, crazed, soft floor which will steadily disintegrate and for which the only remedy is proper replacement. Some contractors or cement finishers have the habit of putting a shake of neat cement on the surface of the floor in order that the floor can be troweled slick. They are, as a rule, under the mistaken opinion that cement is the hardest part of the concrete floor and consequently the neat cement shake will present a good wearing surface. Not only is this belief incorrect, but their practice is almost a positive method of obtaining a crazed surface.

The correct method of finishing a concrete floor is to have as dry a mix as can be floated and troweled. The floating process should not be continued until a large excess of water, cement and fines are brought to the surface but only until the surface has no irregularities and can be worked under the trowel. If at this stage the trowel brings a lot of moisture to the surface, the floor should be let stand until such time as only a small amount is brought to the surface. Following the first troweling the floor should be left until it starts to set and then troweled a second time. If an extra hard, smooth finish is desired, the surface should be troweled a third time when it has hardened to the point where the trowel rings on the floor.

Methods of Curing

The three important factors in concrete work—methods of curing, expansion and contraction due to atmospheric moisture and expansion and contraction due to changes in temperature—are so closely related that they may well be considered together. All deal with the conditions affecting the floor during the critical curing period.

From the time a cement floor is laid until the time it is ready to be used, it is undergoing almost constant internal change. We know that concrete may shrink on drying as much as .05 per cent and swell when wet as much as .01 per cent. The necessity for keeping a concrete floor constantly wet during its curing and until the ultimate strength is reached is, therefore, at once apparent. If a concrete floor is laid, allowed to dry out, and then wet for curing purposes, the concrete will be seriously injured and will never attain the strength it would, had it been properly cured. During the succeeding stages of drying out and wetting, the floor is subjected to immense strains which will without question result in crazing and in some cases cracking.

There are two ways of curing a floor. The most common

method is that of spreading a mat of some moisture retaining substance such as clean sand, etc., 1 in. in thickness evenly over the surface the day after the floor has been laid and keeping it thoroughly saturated with water for as long as possible up until 28 days. If the floor is subjected to drafts or the sun, it should be sprinkled and kept wet from the time it sets until thoroughly cured.

The newer and better way of curing concrete and one that entails much less labor and insures even more satisfactory results is to coat the surface of the concrete with a material which will prevent the evaporation of the excess moisture in the floor until at the end of the curing period when it is washed off. This improved curing method enables the concrete floor to attain its maximum strength before the moisture is allowed to evaporate and the process of shrinkage begins. It also does away with all possibility of any expansion due to the addition of water to a dry slab in the process of curing.

Preparation of the Slab Base

In placing a topping on a concrete floor it is necessary to thoroughly saturate the base before applying the topping, otherwise there will be an expansion of the base after the topping has been laid thereby causing cracks to appear in the topping. A topping 1½ in. thick is recommended so that there will be enough mass to take care of any stresses which may be set up between the base and the topping.

The Effect of Crazing on Strength

The relationship between crazing and tensile strength referred to in connection with the tests reported above, suggest the importance of the subject and emphasize the need for closer control of materials and methods. The matter of tensile strength resolves itself to the following factors largely: the quality of the cement; the quality of the sand; the closeness of the particles of sand, one to the other; whether or not these particles are completely coated with cementitious material, and the method of mixing, finishing and curing described above.

New Bridge Features Largest Arch Spans in England

Two outstanding claims to distinction are possessed by the Royal Tweed Bridge at Berwick, England, which has just been opened. It is the longest highway bridge in the United Kingdom, and three of its four arched spans are the largest yet constructed of reinforced concrete in Great Britain.

Including the approaches, which measure 204 ft. at the south end and 144 ft. 6 in. at the north, the bridge has a total length of 1,410 ft., the spans of the four arches being respectively 167 ft., 248 ft., 285 ft., and 361 ft. 6 in. The smallest of the spans is at the Tweedmouth shore, and the inequality in their size was adopted in order to accommodate the gradient of the roadway, which rises 1 in 51 from Tweedmouth to Berwick, and also to meet the condition that the first arch on the Berwick side should cross the main flow of the river at low tide. The crown of this arch is about 45 ft. above high-water level. The total width of the bridge between the parapets is 46 ft., giving space for a 30-ft. carriageway and two sidewalks each 8 ft. wide, under which are ducts to contain gas pipes, water mains and electric cables.

The carriageway has a bituminous non-skidding surface, laid 2 in. thick directly upon the reinforced concrete decking, which is formed to the camber of the road. The parapets, which are the only stonework about the bridge, are made of freestone.

The bridge is of conventional reinforced concrete design, the decking of the roadway being carried on columns which rise at intervals from each of the arched ribs of the spans and are monolithic with both the ribs and the decking. Each of the four arched spans consists of four ribs placed with their centers 15 ft. apart. In the largest arch the two outer ribs are 3 ft. 2 in. wide, while the middle pair, which have to take a heavier load, have a width of 5 ft. All of them have a depth of 10 ft. 6 in. at the springings, diminishing to 7 ft. at the crown, but in relation to the size of the whole structure they appear comparatively slender. In the other smaller arches the dimensions are reduced proportionately. The ribs in the smallest span are solid throughout, but in the others, with the object of lessening the deadweight, they have been made hollow for about two-thirds of their length, only the crown portions being solid. They spring from reinforced concrete distribution beams built with the concrete piers and abutments, these beams distributing and transmitting the concentrated loads from the ribs to the foundations. The reinforcement of the ribs is also carried for a considerable distance into the piers and abutments, and in addition a certain amount of the reinforcement of the ribs of one span is taken over the piers into the corresponding ribs of the adjoining span, so that between the abutments at each end of the bridge the arched ribs form one continuous girder, supported at intervals by the intermediate river piers. The bridge is designed to carry a moving load of 50 long tons on four wheels, with an additional superload applied over the area not covered by the moving load. In the largest span the carriageway is calculated for a total load of 700 tons and the footpaths for one of 217 tons, the safe loads on the smaller spans being in proportion.

Construction was started early in 1925, and it was hoped that it would be completed in about two and one-half years. That hope was disappointed largely because of delay caused by difficulties with the foundations of one of the piers. Preliminary borings in the bed of the river indicated that satisfactory foundations would be found in rock or gravel at a depth of 15 to 20 ft. and this anticipation was realized for all the piers except the first from the Berwick side. There excavation revealed at foundation level and a few feet west of the boring, a stratum of running sand and peat which covered about half the area of the pier, and in view of the importance of this pier, which has to take the load—about 10,000 tons—of the largest two spans, it was decided to re-design the foundation and drive reinforced concrete piles over the entire area. To save time these piles were made with rapid hardening cement.

Considerable anxiety was caused to the engineers in charge of the work by an exceedingly severe flood which occurred before completion. To support the concrete while it was hardening temporary timber staging was carried across the river on five rows of timber piles spaced 10 ft. apart, and this staging was still in place for a length of about 650 ft. under the two largest spans, and the concreting of the ribs was still unfinished, when the flood brought down masses of miscellaneous debris, which were held up by the staging and packed by the force of the current into a dam so solid that laborers actually walked upon it. The staging must have been subjected to a tremendous strain, but happily it proved strong enough to resist the pressure and no serious damage was done.

The estimated cost of the bridge and its approaches was £160,000 ($800,000).

Mixer Musings

Reported by "Joe"—The Mixer Boss.

Ambition and a Concrete Swimming Pool

By CHARLES E. BABBS
Office Boy Staff, Main Office, Portland Cement Association

THIS, THE SECOND TALE FROM THE PEN OF THIS AUTHOR PUBLISHED IN THIS COLUMN, IS A "SUCCESS" STORY.

(In Two Parts)

"SAY, Ray, I guess we'll have to split up, when you go to college next fall. Dad says the real estate business has not been very profitable this year, and that he doesn't think that he can afford to send me to college." This came from Ted, who looked extremely downhearted.

Ray dropped his books on the desk, and put his arm around Ted's shoulder. "We'll find some way out of it, Ted. Buck up," he said. But it could be seen that Ray was plainly worried.

Ted Hampton and Ray Jensen were two nineteen-year old high school seniors and they lived in a small town in the Middle West. They were inseparable pals through grammar school and high school. Their ambition was to go to college together.

During vacation they expected to enjoy swimming, fishing, boating and hiking, but they were more fond of swimming than any other sport.

They had numerous medals and trophies, that decorated the walls of their rooms. Ray was a long distance swimmer, while Ted was best at fancy diving and sprinting in the shorter races.

One evening after putting away the boxing gloves, they were talking in Ray's room. "Say, listen 'Peanuts,' can't you think of some way that we could earn enough money to pay our way through college?" It was Ted who had spoken. Ray was looking through a magazine, when suddenly he gave a great whoop of joy and shouted, "I've got it, we'll build a swimming pool!" Both boys, now thoroughly excited, read the advertisement with increased interest. It told of an economical, permanent concrete swimming pool.

Ray spoke first, "Everyone in town can swim in it," he said, "as it is now they must ride thirty miles in an automobile over rough, dusty roads to swim in a muddy lake. Also they must change from their clothing to swimming suits in machines." Ted, excited but smiling, said, "Dad owns a lot near the park that he would let us have at cost and give us plenty of time in which to pay for it." And then he added softly, "Oh, boy, wouldn't that be swell!"

So together, they wrote a letter to the Portland Cement Association, 33 West Grand Avenue, Chicago, Illinois, asking for literature, specifications and blueprints about the concrete swimming pool. This important, but free data, which was made possible by the highly trained technical staff of the Portland Cement Association, was received a few day later.

Watch for the next and concluding chapter of this absorbing story

Joe, the Mixer Boss.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.
Twenty-fifth annual convention, Book-Cadillac hotel, Detroit, Mich., Feb. 12th to 14th.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth St., New York City.

American Road Builders' Association; Miss E. A. Birchland, Secretary, 29 W. Thirty-ninth St., New York City.
1929 convention and road show, Cleveland, Ohio, Jan. 14th to 19th.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; Wharton Clay, Commissioner, 123 W. Madison St., Chicago.

Association of Cast Stone Manufacturers; Frank M. Brooks, Secretary, Pasadena, Calif.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Concrete Products Association; F. O. Matthiessen, Secretary, 644 Drexel Building, Philadelphia, Pa.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.
Fall Meeting, Buckwood Inn, Shawnee on Delaware, Pa., Oct. 1st to 3rd.

Iowa Concrete Products Association; R. L. Gavin, Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.

National Association of Building Trades Employers; A. W. Dickson, Executive Secretary, 2226 Builders Building, Chicago, Ill.

National Association of Builders' Exchanges; Earl F. Stokes, Secretary, 15 E. Fayette St., Baltimore, Md.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 E. Twenty-second St., New York City.

The National Lime Association, Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N.W., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; F. R. Zaugg, Executive Secretary, 803 Seaboard Building, Seattle, Wash.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

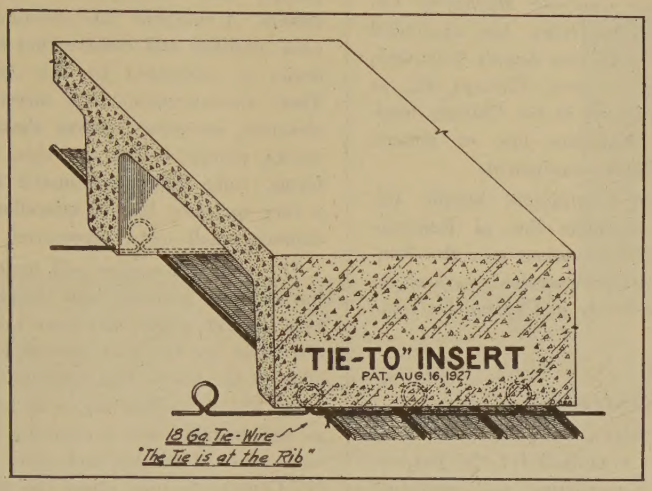
Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 3115 Plankinton Arcade, Milwaukee, Wisconsin.

New Equipment and Materials

"Tie-To" Insert New Metal Lath Hanger

Simplifying the problem of tying metal lath to concrete is the purpose of the new Tie-to inserts. They have been designed especially for use in concrete T-beam floor construction with metal pan forms, where metal lath is applied for ceilings. Hanger rods and channel runners are claimed to be thus unnecessary.

In placing in the saw cut in the soffit piece, the manufacturer states, nothing further than wedging the insert into the saw cut is required, since the insert is but a trifle wider than the cut. The method of tying the metal lath to the inserts is shown in the accompanying illustration. Attention is called to the fact that the lath is tied to the insert at the rib of the lath and not in the mesh.



The Tie-to inserts may also be placed vertically in concrete walls, backing brick, stone or terra cotta veneer to make use of the strong anchor possible by slipping a wire loop around the insert and embedding the loop in the mortar joint. The insert is continuous and said to be available for any irregular spacing of the mortar joints of the veneering medium.

Portable Pumping Units Parts of Manganese Steel

Portable pumping units employing manganese steel for the shell, impeller and discs where shock, wear and abrasion are encountered are a new development of the American Manganese Steel Company.

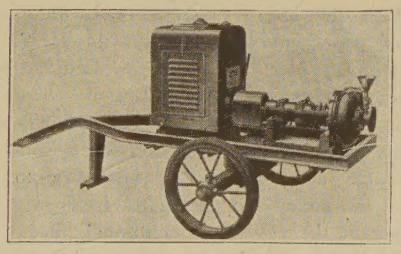
The manufacturer makes these claims for this product:

All parts of the unit are amply proportioned for maximum wear. A long, ring oiling, babbitted, sleeve bearing supports the shaft to which the impeller is press-fitted. The drive shaft is lubricated by a large oil reservoir which also lubricates the amply large thrust bearing.

A ring for a standard pintle hook is provided in the frame for towing purposes. Spring shock absorbers on the axle cushion the jars and blows received in transit, and roller bearinged rubber tired wheels insure easy, quick handling on the road, or when moving the unit from place to place on the job.

All Amsco Portable Pumping Units are powered with Novo Engines. If desired, any other 1200 r.p.m. power unit may be had on option.

The 2 in. unit has a pumping capacity of 100 gallons per minute against a 34 ft.



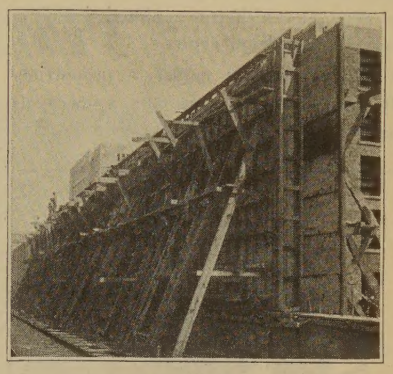
lift with no horizontal discharge hose, and it will maintain the same capacity through 125 ft. of 2 in. hose without vertical lift.

The 2½ in. unit has a pumping capacity of 150 gallons per minute against a 34 ft. lift with no horizontal hose, or through 150 ft. of 2½ in. hose with no lift.

The 3 in. unit has an approximate capacity of 230 gallons per minute against a 37 ft. lift with no horizontal hose on the discharge end. It has an equal capacity with no lift and when discharging through 200 ft. of horizontal hose.

Met-L-Wood Panels Are New Form Covering

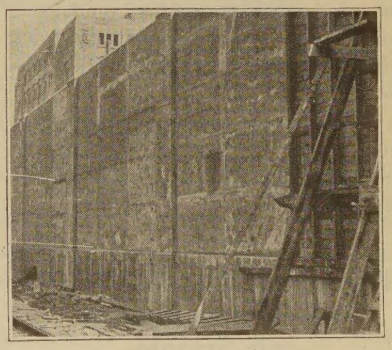
By a fortunate chance a money-saving discovery was made recently by a contractor who wanted to eliminate fins and form marks as much as possible. Reports have it that he made a trial use of Met-L-Wood panels on the inner side of a few



of his forms and is now using them on all.

Met-L-Wood panels are of three-ply poplar plywood faced on one side with an alloy metal sheeting. Contraction and expansion of the steel and wood are provided for by the joint being made through the nap of the fabric. The material is nailed to the formwork. Its use as illustrated is interesting. Two men comprise an adequate force for doing the surfacing, the manufacturer states.

In cutting Met-L-Wood to fit the forms, the saw is held at about a 45 deg. angle. In moving the section of the form to the next job, it has been found best to scrape



the small particles of concrete off the surface before setting them up.

A cut stone effect may be obtained with a Met-L-Wood form by applying moldings of the proper shape over the panels. These moldings can be worked out to come over the joints to eliminate any hand work, it is said.

The Met-L-Wood Corporation, Chicago, is the manufacturer of this product.

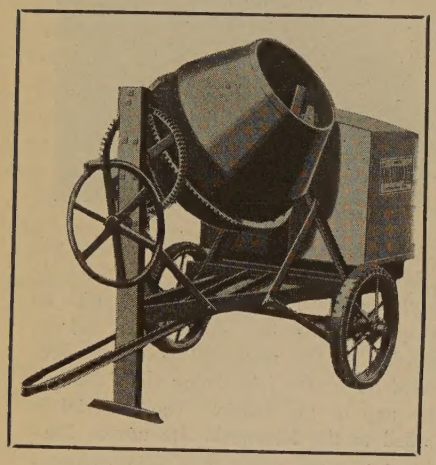
About Makers of Equipment and Materials

NEW EQUIPMENT
(Continued)

Knickerbocker Produces Its First Tilter

The Knickerbocker Company, Jackson, Mich., has entered the tilting mixer field with a batch mixer of 3½ cu. ft. capacity. The firm has hitherto confined itself to mixers of the drum type.

A readily portable model of proportionately small capacity was the aim of its designers. The drum shaft has a bearing



area of 20 inches and revolves with the drum. The drum bottom is a one-piece semi-steel casting to which is bolted a heavy 6-in. steel band. The drum cone is rivetted to this band. The 6-in. middle section of the drum secured by this design, together with the shape, number and placement of the mixing paddles, produces a mixing action closely approximating that in the Knickerbocker non-tilting drum type mixers.

A 2 h.p. Stover engine supplies power, which is in turn applied by malleable pintle chain drive to a sproeket on the main drive shaft.

Ingenious Flexible Steel Rule Makes Measuring Simple

A small, nickel-plated cup about the size of a watch holds what is undoubtedly a unique device—a yardstick that will stretch or shrink and measure around corners. The Farrand Rapid Rule, as it is known, is a thin strip of the "world's finest steel," slightly concaved, and indelibly marked with graduations said to be highly accurate and easily legible, even in dim corners.

It comes to the user coiled in a small cup. With the release of the brakes on the side of the cup, there springs forth a rigid measure — six inches — or six feet — of highly polished, nickeled steel. Applying the brakes stops the rule wherever desired. The rule strips are made in 6-ft. and 2 meter lengths.

Notes from the Field

Ransome Distributors

The Ransome Concrete Machinery Co. of Dunellen, New Jersey, has appointed the *Western Contractors Supply Company*, 14 North Clinton Street, Chicago, Ill., as exclusive distributors in the Chicago territory for the Ransome line of mixers, pavers, and chuting equipment.

The Western Contractors Supply Co. will carry a complete line of Ransome equipment, and have taken over the Ransome factory trained service organization maintained previously in Chicago for some time.

Toll Bridge Financiers

Highway Bridges, Inc., of New York City, has been organized for the purpose of financing, constructing and operating highway toll bridges in various sections of the United States.

P. K. Schuyler is chief engineer of the organization.

Chain Belt Agency

Bacon, Hibbard, Eichman, Inc., Cleveland, contractors' equipment distributors, is a firm formed as the result of the consolidation of two organizations, both of which are well established in the equipment business, and which are joining forces in the interests of larger and more efficient sales and service.

Their major factory account will be the Chain Belt Co.'s line of Rex mixers, Rex pavers, Rex elevators, and conveyors, Durex pumps, saw tables, plaster and mortar mixers. A complete line covering both the road building and construction contractors needs is controlled by this corporation. Their announcement lists mixers, pavers, elevators, conveyors, power shovels, motor trucks, pumps, hoists, saw rigs, steel bins, forms, compressors, pneumatic tools, and a very complete line of miscellaneous machinery, small tools, accessories, etc.

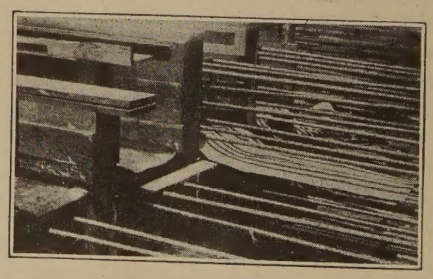
The new corporation will maintain both the business locations and telephone numbers through which they have been serving the trade for the past several years. The office of the Bacon Engineering Sales Company, 251 Erie Building, will be retained as stenographic and accounting headquarters, while the sales and store rooms at 917 Central Avenue, where the partnership of Eichman and Hibbard has in the past handled the W. W. Williams line of equipment, will continue to be the business headquarters and show rooms.

Precasting Concrete Piles with Aid of Reinforced Paper

With the aid of a reinforced, waterproof paper concrete piles for the U. S. government pier at San Diego, Cal., are being precast in horizontal tiers three high. Formerly the piles were cast in a single height and were spread over a considerable area, making it necessary to move the mixer and aggregates frequently to permit the casting of additional piles.

The piles are 20 in. sq., varying in length from 20 ft. to 80 ft., and are reinforced with steel rods. Wooden forms are used for the sides and reinforced paper known as Sisalkraft, is used between pairs of the piles. On the sides surfaced boards are used to secure smooth faces, but the reinforced paper alone is said to produce smooth bottoms and tops for the piles as well as easy separation of the tiers. After a pile has stood 24 hours, a long strip of Sisalkraft is laid over it and the next pile poured on top.

From 25 to 48 piles are made per day, the number depending mainly on the placing of the reinforcing steel rods. The Sisalkraft is purchased in rolls 60 inches wide and the strips are cut as needed in the rolls. Only one man is required for cutting the strips and placing them on completed piles. Water is sprayed over the



sets of piles so as to keep them wet all the time, yet workmen clamber around over the wet, tough paper without tearing it. To date 668 piles have been made, and when the concrete deck is poured, the Sisalkraft, which is now being used between tiers, will be used to cover the deck during the curing period.